POSTERIOR POLAR CATARACT – ASSESSMENT OF RISK FACTORS AND SURGICAL OUTCOME

DISSERTATION SUBMITTED FOR

MS (Branch III) Ophthalmology

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CERTIFICATE

Certified that this dissertation entitled **"Posterior Polar Cataract – Assessment of Risk Factors and Surgical Outcome"**submitted for MS (Branch III) Ophthalmology, April 2014, is the bonafide work done by **DR.AGNES SYLVIA S,** under our supervision and guidance in the cataract clinic and IOL Services of Aravind Eye Hospital and Post Graduate Institute of Ophthalmology, Madurai, during her residency period from May 2011 to April 2014.

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ABSTRACT

Posterior polar cataract- Assessment of risk factors and surgical outcome

AIM

To report the surgical and visual outcome and to assess the risk factors for posterior capsular rupture in posterior polar cataracts

OBJECTIVES

1. To describe the surgical procedure used
2. To describe the intraoperative complication and the stage at which it occurred.
3. To document the postoperative visual outcome
4. To document any postoperative intervention done(if needed)

STUDY DESIGN: A Prospective study of 100 individual eyes, who presented to Aravind eye hospital, Madurai with Posterior polar cataract

STUDY PERIOD

January 2012 to June 2012

METHODOLOGY

Patients diagnosed with posterior polar cataract was included in the study and detailed preoperative examination was done including type of posterior polar cataract if associated with nuclear sclerosis or posterior subcapsular opacity or

presence of pre existing capsular defect, dilated fundus examination, intraocular pressure, A-scan keratometry using IOL master. Surgical technique includes both Small incision cataract surgery and phacoemulsification. Type of surgery done was noted and intraoperative complication and the step at which it occurred, any intervention done was also noted. Hydro delineation was done in all cases. The phaco parameters used were 250 to 300mmHg vaccum, 50% power. Nucleus emulsification was done at an increased 300 to 350mmHg vaccum depending on the grade of the nucleus using same power. Throughout the procedure the bottle height was kept at 100cm with irrigation flow rate was maintained around 26mL/min. Post operative visual acuity on day 1, 1 month and 6 month follow up were recorded. During each visit both uncorrected and best corrected visual acuity using snellen's chart was recorded. Post operative complication following surgery if any was noted.

RESULTS

The mean age of presentation was 47 years with majority of the patients below the age of 50 years.The youngest patient presented was 20 years and the oldest patient was 70 years. There was no sex predilection in general (Male 48%, Female 52%). Most common symptom in younger age group of patients was glare and difficult night driving. Out of 100 cases, Posterior polar cataract was also seen in association with Posterior subcapsular cataract (4%), with nuclear sclerosis (23%) and 2% of the cases was associated with pre existing posterior

capsular dehiscence. 41% of the cases had small incision cataract surgery and 59% of patients underwent phacoemulsification. Most common intraoperative complication was Posterior capsular rupture accounting for about 8% of the cases. This can be attributed to the modified surgical technique and awareness of the weak posterior capsule. Residual posterior capsular plaque was seen in 4% of the cases which was managed with Nd- Yag capsulotomy postoperatively. Postoperative vision had significantly improved when compared to the baseline vision (p-value < 0.001) except for 1 case which stayed the same due to marked amblyopia.

CONCLUSION

Though the management of posterior polar cataract poses challenge even for experienced surgeons, choosing a closed chamber surgical procedure, achieving a good capsulorhexis, adoption of certain modified surgical techniques which causes minimal stress on the zonules and on the posterior capsule, removing the central epinuclear shell as a last part of cortical clean up carefully, avoiding nucleus rotation, posterior capsule polishing can result in favourable surgical outcome. Though the surgical technique may vary with each individual surgeon, special attention paid to these details can help during the procedure and result in the safe outcome. Preoperative counselling of the patient and explaining the complications expected is mandatory. In the event of any complication or breach in posterior capsule adequate follow up of the patients is necessary.

CONTENTS

PART- I

PART-II

INTRODUCTION

During the past decades the advances in cataract surgery have not only been phenomenal but also have been gratifying to both the surgeon and patients. Cataract surgeries are being performed at an earlier stage these days and patient awareness is much more when compared previously. As a result more patients are being recognised as a possibility of having posterior polar cataract.

Posterior polar cataract accounts for about 0.5% to 1% of all cataracts and relatively uncommon type of cataract. PPC presents a special challenge to surgeons because these eyes have predisposition to posterior capsular rupture during surgery [1] . The incidence of capsular weakness at the site of polar opacity makes it even more vulnerable for complications during surgery. Although older studies have reported 26-36% [2,3] 0f posterior capsular rupture, the recent studies reveal lesser rate (7.1 to 16.7%) [4,5,6] due to increased awareness and adoptability of modified surgical techniques.

Patients with posterior polar cataract are relatively younger age group (30-50 years). Bilateral presentation is more common accounting for about 65 to 80% of the cases [7,8]. There is no sex predilection in general. The most common presenting symptom is glare, difficult night driving. So the timing of surgery is crucial. It can be delayed as long as the patient is able to

perform his routine activities. The relative technical difficulty should be kept in mind while taking the patients for surgery as it involves effective removal of soft nucleus in most cases and successful protection of posterior capsule.

DEVELOPMENT OF THE LENS[9,10]

Lens embryology and its relative knowledge help us in understanding the anatomy of the lens and the formation and nature of various types of cataracts. The rudimentary lens is first seen as a thickening of the surface ectoderm, the lens placode at about 22 days of gestation which overlies the optic vesicle. Bone morphogenetic protein (BMP) family of growth factors are necessary for the development of lens placode and for subsequent lens formation. At about 29 days of gestation the infolding or the indentation of the lens placode forms the lens pit. This lens pit further deepens and invaginates resulting in the formation of lens vesicle.

Lens vesicle

Due to the continued invagination of the lens pit, the stalk of cells connecting it to the overlying surface ectoderm degenerates by means of apoptosis thereby separating the lens cells from the surface ectoderm. The resultant of which forms a single layer of cuboidal cells covered by a basement membrane is called the lens vesicle. The basal cells covering the lens vesicle differentiates throughout life resulting in a progressively thicker basement membrane forming the lens capsule. The lens vesicle is approximately about 0.2mm in diameter at the time of formation (30 days of gestation)

Because the lens vesicle was formed as a result of surface ectoderm invagination, the apices of the cuboidal cells are directed toward the lumen of lens vesicle, with the base attached to the lens capsule around the periphery of the vesicle.

Primary lens fibers

The originally formed cuboidal vesicle cells are transformed in to long fiber like cells. These cells stop dividing and begin to elongate. They fill the entire lumen of the lens vesicle as they continue to elongate. The lumen becomes obliterated at about 40 days of gestation. These elongated cells filling the entire lumen are called the primary lens fibers. These fiber cells as they mature undergo a process of degradation that reduces the light scattering. These primary lens fibres form the embryonic nucleus which occupies the central area of the adult lens.

The anterior lens vesicle cells stay as a single layered cuboidal cells lens epithelium. Further growth of lens throughout life occurs as a result of proliferation within the lens epithelium.

Secondary lens fibres

With subsequent proliferation all the epithelial cells close to the equator elongate forming the secondary lens fibres. New secondary lens fibres are formed throughout life. The anterior aspect of the newly formed

lens fibre extends towards the anterior pole of the lens, while the posterior aspect extends along the capsule towards the posterior pole of the lens. In this fashion the lens fibres are laid down concentrically acquiring a laminated appearance on cross section. The secondary lens fibres are laid down between 2 and 8 months of gestation, forming the foetal nucleus.

Lens sutures

As these lens fibres are produced throughout, we can observe that none of the fibres run completely from anterior to posterior surface of the lens. These fibres interdigitate and the ends of the fibres come into apposition at sites and these patterns are termed as sutures. Since no fibres pass from pole to pole those that begin near the pole on one surface end near the peripheral extremity on the other and vice versa. Y shaped suture is the anterior suture line seen at about 8 weeks of gestation, that is inverted on the posterior aspect. With the continued formation and growth of lens fibres the suture patterns can become more complex. About 12 or more suture branches can be observed in adult lens.

Tunica vasculosa lentis

During the early part of development (about 1 month of gestation) the lens grows rapidly as it is supplied by the hyaloid artery which branches to form a plexus of capillaries on the posterior surface of the lens capsule. This

capillary network is called as tunica vasculosa lentis. Later this blood supply regresses, disappears by means of programmed cell death just before birth.

Suspensory ligaments of lens (Zonules)

The zonular fibres are secreted by the ciliary epithelium which is formed by the mesenchyme situated at the edge of the optic cup. However the exact mechanism of insertion of these fibres in to the lens capsule is not known.

ANATOMY OF THE LENS[9,10,11]

The crystalline lens is a transparent, biconvex, elliptical avascular structure located between the iris and the vitreous in a saucer shaped depression, the patellar fossa. The posterior lens capsule is in close contact with the vitreous by means of ligamentum hyaloidocapsulare. Between the lens capsule and the hyaloid there lies a space called as the retrolental space or the berger's space.

The equatorial diameter of the lens at birth is about 6.5mm which increases to 9-10mm later in the second decade of life and thereafter it remains constant. By measurements its axial diameter changes with age from 3.5 at birth to 4mm at around 40 years of life and finally reaching almost 5mm in old age. It can differ with accommodation. An adult lens weighs about 255mgs.

The human lens has two surfaces, the anterior surface and posterior surface. The posterior surface is more convex when compared to the anterior surface. The anterior surface represents a segment of sphere measuring about 8 to 15mm averaging 10mm. Posterior surface is more curved and has radius about 6mm(4.5 to 7.5mm) Both the surface meet at the equator which forms a circle and has rippled or undulated appearance.

Central part of the anterior and posterior surfaces are known as anterior pole and the posterior pole.

Lens has a refractive index of 1.39 of which the nucleus is 1.32, cortex is of 1.38. The refractive index of lens is slightly more than the aqueous and the vitreous and because of this reason it exerts a less dioptric effect than the cornea. Lens accounts for about 15 diopters of the total 55 diopters of the eye. Accommodative power also varies with age. It is 15 to16 D at birth reducing to almost half at the age of 25 and finally 1 to 2 D at the age of 50 years.

The lens colour also changes with age. It is almost transparent at birth and in younger individuals, then acquiring a yellow tinge around the age of 40 years and finally becomes amber coloured as the age advances. In a slit beam when the pupil is dilated the stratification of lens in to various concentric layers can be observed. The nucleus and the lens cortex consistency also differs.

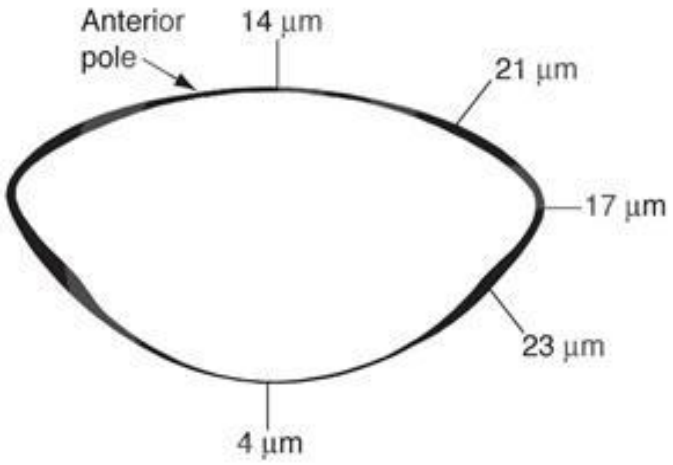
Structure of the lens

Lens capsule

The capsule of the lens is a transparent, thin, homogenous and hyaline collagenous membrane that surrounds the entire lens. The lens capsule represents the basement membrane of the lens epithelium. It is the thickest

membrane of the body because of the fact that it is formed continuously throughout life. Though the lens capsule is elastic, no elastic tissue is actually found. The thickness of the lens capsule differs with age and is not uniform in consistency in its entire extent. It is produced by the basal cells of lens epithelium in its anterior part and by the basal area of elongating fibres in its posterior aspect.

The lens capsule is much thicker in front than in behind and the anterior and posterior portions are thicker towards the equator which is just within the suspensory ligament attachment than at the poles. It is thinnest in its posterior pole than the anterior pole. The thickness at the posterior pole is 2.8- 4 μm and at anterior pole is 15.5 μm.



Schematic of Human lens capsule- showing thickness of capsule in different zones

Under the light microscope the lens capsule appears as a transparent, homogenous birefringent structure which stains with PAS. It has a lamellar appearance with its fibres arranged parallel to its surface. However in an electron microscopy the lens capsule shows an amorphous appearance.

The lens capsule is chiefly made up of collagen type IV and about 10% of glycosaminoglycans. Lens capsule cannot be considered to have an independent metabolism although it contains enzymes, ATP and glycolytic intermediates.

Zonular fibres

Zonular fibres are the fibres which provide support to the lens which develop the non pigmented epithelium of the pars plana and pars plicata of the ciliary body. The fibres insert on the capsule of the lens which is about 1.5mm in the anterior portion of the lens capsule and 1.25mm in the posterior part of the lens capsule. The fibres usually get inserted in the equatorial part of the capsule both anteriorly and posteriorly. The zonular fibres measures about 5 to 30microm in diameter.

Lens epithelium

Lens epithelium is made up of monolayer of cuboidal epithelial cells which are nucleated and lies immediately behind the anterior lens capsule. This layer is metabolically active as it contains all the organelles necessary for the metabolic, synthetic and various transport process. Anterior lens

epithelium differentiates into columnar shaped cells in the equatorial region and they are the ones which continue to divide and elongate to form new lens fibres throughout life by the process of mitosis. As the epithelial cells elongate to form the lens fibres, it is associated with the increase in the mass of cellular proteins in the membranes of each cell.

Zones of lens epithelium

Central Zone

Central zone of cells are cuboidal with their nuclei located apically. Their cells gradually decrease in number as the age progresses. They do not undergo mitosis but they can do so in situations like an injury. Anterior subcapsular cataract can result from the metaplasia of these central zone of cells under certain conditions.

Intermediate zone

This zone consists of more cylindrical cells located peripheral to the central zone. Mitosis occurs occasionally in this zone of cells.

Germinative zone

Germinative zone is made up of columnar type of cells. These cells are actively involved in mitosis resulting in new lens fibres throughout life. They are more susceptible for radiation. Dysplasia of these cells can result in posterior subcapsular cataract under susceptible conditions.

Lens fibres

Formation

Lens epithelial cells elongate resulting in lens fibres. Initially these fibres are formed from posterior epithelium. These posteriorly formed fibres run from posterior to anterior direction to fill the lens vesicle. Later the lens fibres are formed from the anterior epithelium, the equatorial part. These fibres which are laid down from the anterior epithelium continuously elongate and differentiate to form the main bulk of the lens.

Structure of the lens fibres

The lens fibres are hexagonal in shape in cross section. They contain all the organelles such as golgi apparatus, mitochondria, rough endosplasmic reticulum, polysomes along with nucleus. These lens fibres contain interlocking processes between the cells.

Structural arrangement

The foetal nucleus is formed by initial fibres that surround embryonic nucleus to form a Y shaped suture at the termination on the posterior and anterior lens surface. In the later stages of gestational period after birth there is irregular growth of lens suture, more or less like a dendrite pattern. This is because of an asymmetric growth of lens fibres.

Zonal arrangement:

The formation of lens fibres is continuous throughout life. Arrangement of these fibres are in such a way that they represent various demarcated developmental stages. The lens fibres are arranged more compactly into cortex and nucleus more distinctly.

Nucleus

Nucleus contains oldest fibres in the center and differentiated into three zones. The innermost zone consist of embryonic nucleus, arranged successively is the foetal nucleus, then comes the infantile nucleus and finally the adult nucleus. These represent the various stages of development of the lens. The embryonic and foetal nucleus remain constant in their size while the adult nucleus is constantly increasing in size.

Cortex

Cortex comprises the peripheral part and it constitutes the most newly formed lens fibres. Different parts of cortex has been described in the literature as

- Peripheral cortex which is lying beneath the posterior capsule
- Supranuclear cortex is found close to the nucleus
- Epinucleus which is similar to the supranuclear region

- Sutures

Cortical fibres are formed continuously and posterior part of the cortex is found to be thinner than the anterior cortex.

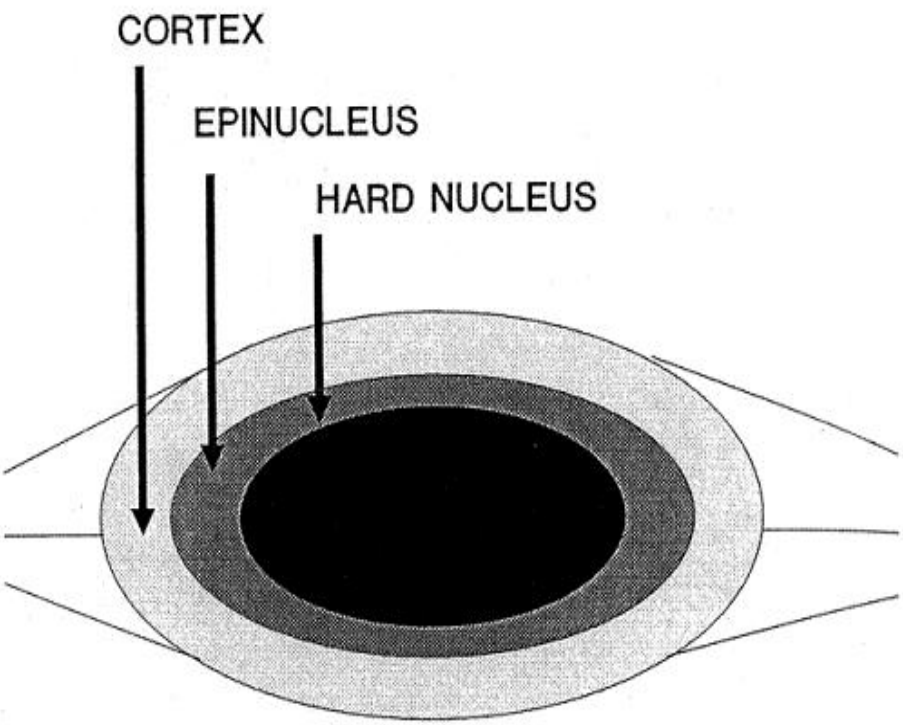
Lens Zonules

The zonular fibres develop from the non pigmented epithelium of the ciliary process which is the continuation of the internal limiting membrane. The zonules gradually increase in number, tensile strength and density. The zonules merge with the anterior and posterior lens capsule providing good mechanical support for the lens.

Surgical anatomy

In view of the surgical aspect, the crystalline lens is divided into four different zones

1. The central nucleus
2. An epinuclear sheath
3. Layer of cortex
4. Capsule.



The nucleus forms the innermost layer of the lens and the hardness increases with aging. The epinuclear sheath is a layer around the nucleus which is a semi soft lens matter. This layer needs a large bore cannula for aspiration and hence it is better managed by hydro or visco expression. Hydro delineation is generally done for the separation of nucleus from epinucleus.The cortex is a thin layer present immediately beneath the capsule. It covers the epinucleus. This layer of cortex can be aspirated or irrigated out of the capsular bag without much difficulty.

CATARACTOGENESIS[12]

Transparency of the lens

The relative transparency of the lens depends on the uniform of arrangement of the lens fibres and the cytoplasmic organelle within each fibre. Disturbance in the regular arrangement of these fibres or the cytoplasm within the fibre can lead to opacification of the lens and hence can result in the formation of various types of cataract.

Human lens maintain its transparency due to the regular and orderly arrangement of the lens fibres with little or minimal extracellular spaces. Inside these lens fibres transparency can be explained by the spatial fluctuations in the protein molecules when compared to the wavelength. Because of the presence of these protein molecules in large number they hardly scatter any light independently of each other. These protein molecules join together to form large aggregates and this explains the mechanism of scattering within the cytoplasm. At microscopic level the opacification of the lens is explained by the disorganisation of the fibre membranes and at the molecular level by the lens proteins. These processes can happen independently or together in the morphology of various types of cataracts. The type of cataract in any eye depends on the adverse influences happens in the lens fibre and a part played by the hereditary component.

This is similar for both cataract seen in young age as well as an age related cataract.

Aging of the lens

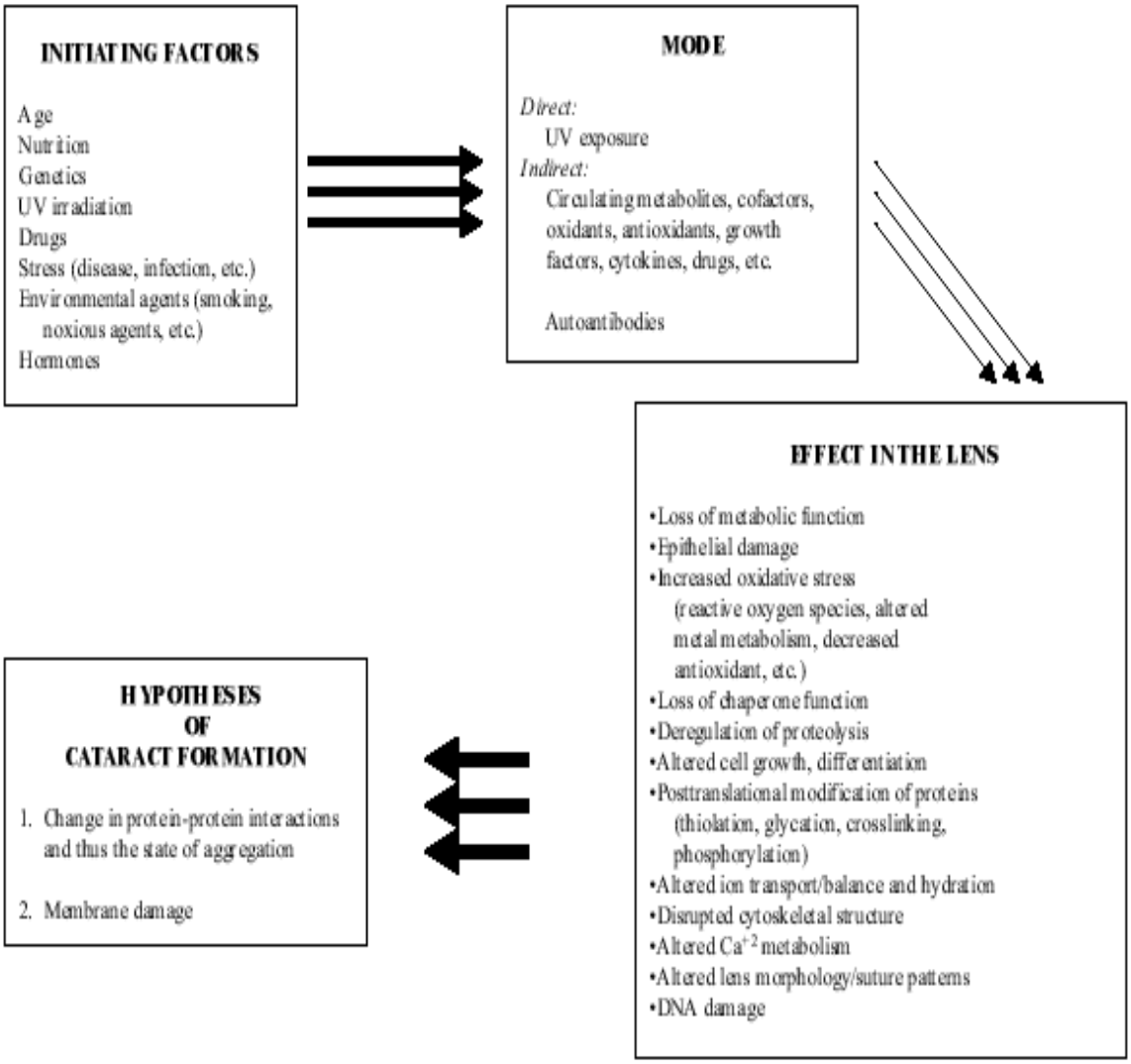
With normal aging the lens increases in its overall size both in weight and thickness and decreases in its ability to accommodate. As the lens fibres are formed continuously throughout life the lens gets compressed and hardened becoming less pliable. Modification takes place at the level of protein molecules resulting in protein molecular aggregates and hence the normal transparency of the lens gradually decreases. Chemical activity can lead to pigment deposition by these lens proteins. As the pigmentation increases the colour of the lens becomes yellow gradually becoming brown and the hardening of the nucleus also increases. The mechanism of scattering is also altered resulting in loss of transparency of the lens.

Enzymatic changes are also seen as the lens ages. The level of potassium decreases with age. Also the concentration of glutathione, a free radical scavenger decreases in an aging lens. The lens becomes more susceptible for oxidative damage as the glutathione level decreases and denaturation of proteins occurs due to this oxidative stress. The concentration of calcium and sodium increases responsible for the increase

in water content of the lens. This is seen secondary to the reduced enzymatic activity in the lens.

With aging there can be formation of nuclear, cortical, subcapsular cataracts. Cataracts tend to progress gradually with age. They cause impairment of visual acuity for distant than for near. Patients will experience a decrease in colour perception, decrease in contrast sensitivity and may become myopic. Apart from reduced visual acuity they may also experience monocular double or triple vision. Cataracts are clinically classified depending upon their age of onset, nature of opacification, mode in which it is acquired, appearance and cause.

Cataract formation can be explained by a number of identifiable mechanisms. Thorough understanding about the evolution of the cataract and basics of cataract can help us in evaluation and management of individual patient.



SCHEMATIC DIAGRAM SHOWING CATARACTOGENESIS

POSTERIOR POLAR CATARACT

Morphology

Posterior polar cataracts are seen as dense white opacities occupying the central part of the posterior capsule. These cataracts can sometimes be a variant of developmental cataract. The incidence of posterior polar cataract is found to be 3 to 5 in 1000 [4,13,14]. At birth lens may have small opacities at which may become cataractous at a later stage in adult life. Posterior polar cataracts appear differently than the regular posterior sub capsular axial opacity seen in younger age group.

Classification

There are various types of classification of posterior polar cataract. However the most commonly accepted one is **the Duke Elder classification** [1]. He classifies PPC in to two types

- Stationary type, most commonly seen (about 65%). It is described as a well defined central circular opacity with concentric rings on the central posterior capsule. It is typically referred as a bull's eye appearance. It may or may not be associated with nuclear sclerosis. Occasionally a small satellite rosette lesion may be observed. Stationary type of PPC usually preserve good visual acuity.

- Progressive type, characterised by white opacification in the posterior cortex in the form of radiating rider opacities. The opacities may extent posteriorly to involve the origin of the posterior polar opacity. This type obscure vision earlier and patients become symptomatic than in the stationary type. The typical bull's eye appearance may not be present in this type of PPC.

Singh Classification[13]

Type 1: The posterior polar opacity is associated with posterior sub capsular cataract

Type 2: Sharply defined round or oval opacity with ringed appearance like an onion with or without grayish spots at the edge.

Type 3: Sharply defined round or oval opacity associated with thin or absent posterior capsule.

Type 4: Combination of the above three types with nuclear sclerosis

Schroeder's grading of posterior polar cataract paediatric age group [15] **based on its effect on pupillary obstruction in the red reflex.**

Grade 1- Small opacity without any effect on the optical part of the lens

Grade 2- Two thirds obscuration without any effect

Grade 3- Disc like opacity with surrounding areas of optical distortion

Grade 4- Complete opacification with on clear red reflex seen.

Pathology of posterior polar cataract

The formation of any opacity in the lens basically depends upon the lens anatomy and the various developmental phases of the lens and at which stage the insult has occurred. The embryologic lens obtain its nourishment via the rich network of capillary tissue called as tunica vasculosa lentis. It is primarily supplied by the hyaloid artery, a branch of primary dorsal ophthalmic artery.

The blood vessels of the pupillary membrane also anastomose with hyaloid artery in its anterior part. Posterior polar cataracts are seen due to failure of regression of hyaloid artery[16,17]. Sometimes the mesoblastic tissue may invade the developing lens[18,19] can also result in the formation of polar cataract. These posterior polar opacities are usually formed during the embryologic development and can remain asymptomatic till third decade. The most common presenting complaint of the patients is glare rather than obscuration of vision. The exact pathologic mechanism of posterior polar cataract is not yet fully understood. Many propose genetic mutation [20] may result in this type of cataract. Deviation of lens fibres from normal development and formation of opacity closely adherent to the posterior capsule has been observed.

Dysplasia of the lens fibres as they migrate posteriorly from the equator of the lens result in gradual increase in opacity which ultimately

leads to further degenerative changes[21,22,23]. Deposition of extracellular material are also seen associated with posterior polar cataract. All these above mentioned changes form a typical discoid or whorl like opacity in the posterior capsule. The capsule is found to be extremely thin at the region of opacity. About 20% of the cases may show congenital posterior capsular dehiscence, as quoted in the literature[2].

Posterior capsular rupture is the most common complication seen during the surgical procedure. The proposed reason is that the close adherence of cataract to the posterior capsule and the other is the extreme weakness and thinning of the posterior capsule at the attachment site.

Genetic basis

There has been various elaborative study on the genetic basis of posterior polar cataract. Polar cataracts can be sporadic or familial. Sporadic cases usually have unilateral presentation. These are seen due to the persistent hyaloid artery which fail to regress. Familial forms are most commonly bilateral and have autosomal dominant pattern of inheritance[24]. Recent studies revealed five loci of autosomal dominant form of posterior polar cataract. These include CRYAB and PITX3[25] on chromosomes 11q and 10q and three loci with unknown genes on 1p,16q22 and 20p[4]. PITX3 gene codes for a transcription factor which is involved in the anterior

segment and lens development. The exact mechanism of maldevelopment of the fibres has not been fully established.

Clinical manifestation

Symptoms

- Most common age of presentation is between 30 to 50 years
- Patients typically present with excessive glare
- Difficult night driving. This becomes very cumbersome for professional drivers.
- Difficult in reading small letters
- Reduced contrast sensitivity
- Vision is usually affected at a later stage or a bit earlier when there in nuclear sclerosis associated with it.

When the cataract is present from childhood it can manifest strabismus and patient might end up in amblyopia.

Slit lamp examination

Diagnosis of posterior polar cataract is typically evident and does not require any special techniques.

- Central well circumscribed opacity, typically giving a bull's eye appearance
- Sometimes radiating opacities may also be seen. The lens might contain degenerated material.

- Pre existing posterior capsular dehiscence should be looked for.
- Lens thickness is also noted.
- Anterior vitreous may show small vacuoles or oil droplets and lens material[16,19]
- Any associated features are also noted

Timing of surgery

Difficulty in performing the routine activities is the important issue and surgery can be done in these patients at an earlier stage. Moreover the posterior capsule becomes more compromised as the age progresses and capsular defects may occur in previously intact capsule. Thinning of the posterior capsule has also been observed. So surgery can be advocated in an early stage when the nucleus is soft and hence the observed complications are also less.

Counselling of the patient

The patients are counselled about his condition and the intraoperative complications associated with posterior polar cataract. He/ She should be informed about,

- Risk of posterior capsular rupture during surgery
- Possibility of nucleus drop and a need for additional surgery (Secondary posterior segment intervention)
- Relatively longer surgical time

- Risk of vitreous loss during surgery
- Presence of primary capsular opacification or thick capsular plaque and need for Nd YAG laser capsulotomy[2,3,26] at later stage and hence late visual recovery
- Possibility of amblyopia especially in unilateral cataracts[26]
- Genetic counselling and screening of the family as posterior polar cataract tends to be an autosomal dominant condition

A written consent is taken from the patient after a thorough counselling.

Preoperative evaluation

Detailed slit lamp evaluation should be done for any anterior segment pathology, anterior chamber depth, pupil size after dilatation, type of posterior polar cataract, any pre existing posterior capsular defects, thickness of the lens and examination of the fundus.

Intraocular pressure should be measured and a detailed A-scan biometry of the eye to be operated should be done.

SURGICAL MANAGEMENT

Surgical management of posterior polar cataract involves various techniques and careful management of the posterior capsule because of its tendency to rupture or dehise at any step during the procedure. Appropriate selection of the surgical modality depends on the type of cataract and the presence of posterior capsular dehiscence at the time of presentation. Complication rate of posterior capsular rupture has been reported as 26% by osher et al[2] which occurred during epinucleus removal, varying to 36% by vasavada[3] and his collegues reported capsular rupture during posterior capsule cleanup or removal of polar opacity. So choosing right surgical technique plays an important role in avoiding any type of complication.

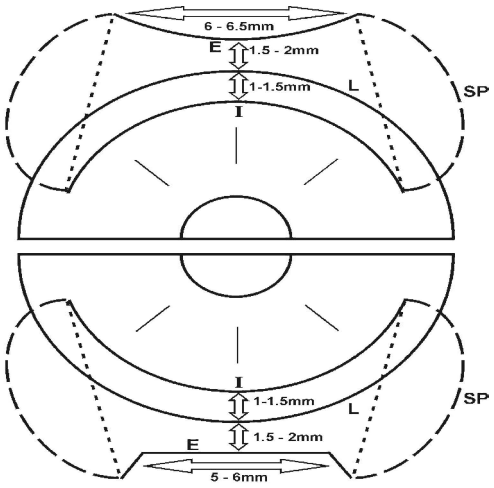
Maintenance of anterior chamber throughout surgery is essential and hence closed chamber techniques like small incision cataract surgery or phacoemulsification is more preferred then the extra capsular extraction. The main catch in PPC is that there is no clear margin between the capsule and the polar opacity, thus understanding the basic principle and through knowledge about the anatomy of the posterior capsule can help us in the management of posterior polar cataract. Assumption that the posterior capsule is deficient in any case posterior polar cataract can lead to better surgical management. Decision to operate and the timing of the surgery are crucial for the surgeon as well as for the patient.

This section describes in detail about the various surgical modalities for the management of posterior polar cataract.

Small incision cataract surgery[27]

Sclerocorneal tunnel incision

Construction of the sclerocorneal tunnel is of primary importance in SICS. The ease of the surgery and the final outcome mainly depends on the wound construction. Mastering the tunnel incision plays a vital role in SICS. There are two incisions, one is the external incision which is the scleral part and the internal incision which is the corneal part.



E = External Incision; I = Internal Incision; L = Limbus; SP= Side Pockets

Incision Anatomy : The upper part of the figure illustrates the frown incision whereas the lower illustrate the straight or scratch incision with backward extensions which are almost perpendicular to limbus

Construction of the external scleral wound has its importance in the self sealing nature of the wound. Smaller incisions have better sealing property however difficult for nucleus delivery and IOL placement. Hence scleral incisions are constructed in such a way that it lends itself for

stretching. The size of the incision depends on the size of the nucleus and the hardness of the cataract. External scleral incisions can be of two types, one is the frown incision and the other is the straight scratch of about 5.5 to 6mm in size at both ends with extending side pockets. The internal corneal incision does not stretch hence it should be made large enough to accommodate the nucleus or the intraocular lens implant. So it should be around 8 to 9mm and the incision should lie parallel to the limbus and not cut through it. Also supports the self sealing property and helps in the anti astigmatic effect.

Bard-parker blade no 11/15 can be used to make the external incision. The tunnel construction is done with a cresent with its bevel up, and a uniform plane is maintained throughout the tunnel construction. Dissection is done anteriorly till limbus and then lateral movement of the crescent helps us in extending on either sides thus creating side pockets. These side pockets are important for extension of the incision helps in holding the bulk of the nucleus during its delivery.

A side port entry is made with either a lance tip or MVR 20G knife and viscoelastic is injected to make the eye hypertensive. This is a very important step as it facilitates in further dissection by making the eyeball taut.

Internal corneal lip construction is with the help of 3.2mm sharp angled keratome. Side to side movement is done to prevent any premature entry. The keratome is dipped downwards while making the entry thus creating a triplanar incision. Corneal incision is extended by forward and lateral movement of the keratome and tissue cutting is avoided while withdrawing the keratome. So a uniform triplanar incision is made.

Capsulorhexis

A continous curvilinear capsulorhexis can be made either through the side port or through the main sclerocorneal tunnel. Ideal size of the rhexis should be 6.5 to 7mm in case of SICS. This provides adequate space for the prolapse of nucleus in anterior chamber. Dye can be used where there is poor red reflux to facilitate the completion of capsulorhexis.

Hydro procedures

Hydro procedures are done with 2cc disposable syringe and the smaller the amount of fluid injected the better the control over the procedure.

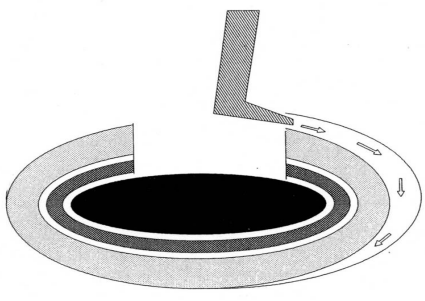
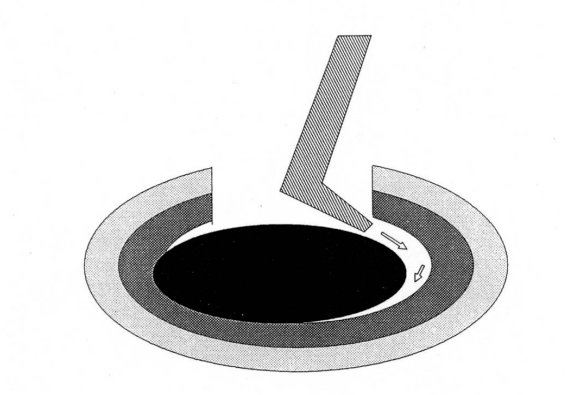


Diagram showing hydrodissection, between the capsule and epinucleus/cortex

Hydro dissection is invariably contraindicated in all posterior polar cataracts as unwarranted fluid injection might result in posterior capsular rent.

Hence controlled hydro delineation is done in all cases. This procedure is also known as hydro delamination or hydro demarcation as it separates the epinucleus from the nucleus and provides a safe cushion upon which the nucleus can be delivered. An intact capsulorhexis makes the hydro delineation much more safer. Rotation of the nucleus inside the bag is avoided in all cases of posterior polar cataract.



Hydro delineation between the nucleus and epinucleus

Nucleus delivery

The nucleus, once it is free from the epinucleus which is evident by the appearance of the golden ring is prolapsed in to anterior chamber by wheeling it out slowly. This manuovre should be very gentle and should not cause stress on the zonules or on the posterior capsule. In posterior polar

cataracts the capsule is very thin at the area of the opacity, the capsule can give away easily even with minimal increase in pressure. The nucleus can be delivered as a whole using a wire vectis or in some cases few authors recommend Phaco fracture technique. This technique uses a wire vectis below to support the nucleus and a sinsky anterior to it to break it into unequal halves. This can be visco or vectis delivered.

Alternatively Blumenthal technique is also described in the management of nucleus in some cases of posterior polar cataract. Anterior chamber maintainer is used and once the nucleus is in AC, lens glide is used to engage the nucleus. Gentle stroking of the glide is done to engage the nucleus completely. Once the nucleus has engaged the inner lip of the wound, the posterior sclera lip is stroked. Gentle side to side rocking of the nucleus can be done to ease its way out of the tunnel. If the nucleus is too hard chipping can be done to facilitate its delivery. Throughout the procedure the AC maintainer is kept and sufficient viscoelstic is injected when required.

Epinucleus and cortex removal

Visco expression of the epinucleus can be done or aspiration the epinucleus can be done slowly with the simcoe cannula. Manual irrigation aspiration has a better safety margin than the automated and gives better control while removing the epinucleus and cortex. Peripheral cortical fibres

are peeled off first in PPC and the central part of the cortex adherent to the posterior capsule is dealt very carefully. Visco expression of the central cortex can be done once it is mobilized from the capsule. If there is a thick residual plaque it is better to leave the plaque without much manipulation. Postoperatively Yag capsulotomy can be done at a later stage. Polishing of the posterior capsule is best avoided in posterior polar cataracts.

In the presence of the posterior capsular rupture the flow and aspiration rate should be reduced and cortical aspiration should be carried out towards the tear without causing much vitreous traction. Dry technique under viscoelastic is advised. The capsular bag is pushed down with viscoelatic substance and it also helps in plugging the area of rupture. Slow aspiration of the cortical matter can be done with simcoe cannula. This causes minimal vitreous disturbance and vitrectomy can be done if indicated.

IOL implantation

In SICS rigid IOL of size 6 to 6.5mm is usually preferred and it is easier to implant through a regular SICS tunnel. If needed enlargement of the tunnel can be done. Sufficient viscoelastic is injected before placing an IOL. The leading haptic goes in to the bag and trailing haptic can either be placed inside using the same lens holding forceps or can be dialed inside the bag with the dialer.

In case of posterior capsular rent and in the absence of an intact rhexis placing the IOL in the bag can be practically difficult. Rigid PMMA intraocular lens can safely be placed in the sulcus in such cases.

Phacoemulsification[28]

Complete knowledge and understanding of the phacomachine is imperative for all surgeons. Though there are various designs of the machine available the basic function of the phacomachine remains the same. Understanding the principles of fluidics and various phaco parameters and their individual effects helps in the effective surgical management and choosing of right parameters for different type of cataracts.

Parts of phaco machine

Handpiece

Three basic functions of phaco machine

- Irrigation
- Aspiration
- Ultrasonic fragmentation

So accordingly there is an Irrigation-aspiration handpiece and ultrasonic handpiece.

The irrigation handpiece is connected to an irrigation cystitome and used only when irrigation is required like in anterior capsulotomy or for hydrodissection. The irrigation aspiration handpiece has a silicon sleeve that fits around the aspirating tip. It is smooth and rounded when compared to the phaco tip and has a single aspiration port at the tip. Different sizes of I-A

tips are available. The most commonly used is the 0.3mm tip and the foot pedal is kept in 2 during this manoeuvre.

Ultrasonic handpiece

Phacoemulsification surgery is based on ultrasonic power, which is an acoustic vibrator delivered via the ultrasonic handpiece. The acoustic vibrator is either a magnetorestrictive or a piezoelectric device. Conversion of electrical to mechanical energy takes place through this device.

Phaco tip

The energy produced by the ultrasonic handpiece via the acoustic vibrator is transmitted to the phaco tip. The tip is made of titanium and is hollow with distal opening serving as the aspiration port. Most commonly used phaco tips are 30 degree and 45 degree.

Phaco power settings

There are various power settings recommended by the manufacturer for different grades of cataract. But the surgeon can set it according to his need and experience. Power settings are adjusted intraoperatively depending upon,

- Density of the nucleus
- Amount of tip engaged
- Linear velocity of the tip during phacoemulsification

Irrigation system

Irrigation system is usually done by gravity feed in most of the phaco machines. Rigid sleeves are preferred over flexible ones and the irrigation bottle height is placed between 65 and 75cm above the eye level. Determination of the amount of irrigation depends on the bottle height relative to the patient's eye, loss of fluid from the eye and by the sleeve diameter.

Aspiration system

Depending on the phaco machine three types of pumps are used to control aspiration and to create the necessary vaccum.

Peristaltic pump

In this type of pump the pressure differential when the tubing gets compressed in a rotator motion. So vaccum is created on occlusion of the port. The fluidics of the peristaltic pump is more controlled and the flow rate and vaccum is independent of each other. Peristaltic pump allows both zero and high vaccum phaco.

Venturi pump

A venture pump uses compressed gas and the vaccum build up is linear. Instantaneous vaccum build up is possible on pressing the foot pedal. Due to this reason it is not recommende for beginners as sudden risk of iris trauma or posterior capsular rupture can occur.

Diaphragmatic pump

Flexible membrane within a cassette is used to create vaccum in diaphragmatic pump. The vaccum build up is even more linear and the preset levels are reached even without occlusion. Control in case of diaphragmatic pump is good in posterior segment surgeries. As the vaccum is created even without occlusion tissues can be pulled towards the centre without approaching it. Unwarranted pulling of the tissues can sometimes result in higher complication rate. So it is definitely unsafe for beginners.

Foot pedal

Position 0- instrument is on, no fluid flow or no ultrasonic vibration

Position 1- Only irrigation is on

Position 2- Irrigation and aspiration occurs the same time

Position 3- Irrigation, aspiration and fragmentation occurs simultaneously

Phaco parameters

- Ultrasound power

  Ultrasound power is usually kept around 50% to 70%. In case of soft cataracts where we less ultrasound power it can be reduced to 30% and in cases of hard nucleus greater power is required and it can increased up to 80% to 85%

- Effective phaco time

  Effective phaco time refers to total time at 100% phaco power. It is significant as it indicates the proportionate energy delivered to the eye at a given time thereby reducing the side effects which can occur due to phaco power

- Phaco power

  Phaco power is the accurate ability of the hand piece to emulsify the nucleus. It is directly propotional to the stroke length and the efficiency of the hand piece

- Stroke length

  Stroke length is given by the distance moved by the titanium hand piece back and forth. It is directly related to the phaco power and the stroke length can be altered by changing the phaco power setting.

- Frequency

  It is given by the number of times the phaco tip moves and it is measured in kiloHZ. Intraoperative adjustment of the power variables can be done depending on the

  - Density of the cataract/nucleus engaged in the tip
  - Amount of tip engaged
  - Linear velocity of the phaco tip during emulsification.

PHACOEMULSIFICATION IN POSTERIOR POLAR CATARACTS

Incision

The incision site in posterior polar cataract in phacoemulsification can be a coaxial one which is either clear corneal or scleral or bimanual micro incision where two clear corneal incisions are placed separately about 60 degrees apart in the temporal side. Maintaining the anterior chamber stability is utmost important to prevent sudden rupture of posterior capsule. Injection of a cohesive viscoelastic aids in stability and sodium hyalorunate injection can create more space in the anterior chamber for further manuovres.

Bimanual micro incisions of 1.4mm are water tight incisions provide better chamber stability described by Haripriya et el[29] in her study. Also the increase in positive pressure as the chamber collapses which is seen in coaxial method can be avoided.

Capsulorhexis

Ideal size of capsulorhexis in posterior polar cataract should be around 5 to 5.5mm, as a larger size rhexis may not provide adequate support for ciliary sulcus fixation of IOL in case of any complication. But in case of harder nucleus a bigger size of rhexis can be opted due to the fact that excess fluid can be released in to the anterior chamber during hydro

delineation thus decreasing the intralenticular pressure. Also it is easier to prolapse the nucleus in the anterior chamber in case of a posterior capsular rent or vitreous loss intraoperatively[30]. However it shouldn't be too large to compromise the support for the placement of intraocular lens[31].

The pressure on the posterior capsule should be avoided while making a rhexis. The flap elevation with an cystitome should be as gentle as possible without making a downward movement which might cause pressure and stress on the zonules, can lead to posterior rent or can enlarge an existing one. Contionous curvilinear capsulorhexis using a forceps has been suggested by Howard fine[31] to avoid the downward pressure caused by cystitome. In another technique, moderate amount of 3% sodium hyaluronate or 4% chondroitin sulphate placed in the sub incisional area which acts as a soft shell on the anterior capsule. Heavy viscoelastics are more useful in younger patients with soft nucleus but is to be avoided in case of hard nucleus that can otherwise exert pressure on posterior capsule.

Hydro procedures

Hydro dissection especially cortical cleavage hydrodissection is strictly avoided in all eyes with posterior polar cataract. However Fine et al[31] suggested multiple small hydrodissection at different quadrants with balanced salt solution. Care to be taken so that the fluid wave does not reach

the posterior capsule. Also the depression or tapping of the lens is not performed as in the regular hydro dissection.

Hydro delineation is the procedure of choice for posterior polar cataracts as it provides an epinuclear cushion separating only the nucleus hence act as protective layer in front of the posterior capsule. Vigorous hydro procedures are best avoided. Decompression of the nucleus after hydro delineation should also be as gentle as possible. Accurate separation of nucleus from the epinucleus is evident from the appearance of golden ring. Inadvertant injection of fluid may not result in a typical appearance of golden ring. In such cases further manipulation like rotation of the nucleus should be avoided. Fluid injection in the correct plane can result in the prolapse of the nucleus out of the epinucleus , seen in soft cataracts.

Inside out delineation

Another method of hydro delineation described by vasavada et al[32] is the inside out delineation. In our regular hydro procedure the fluid wave passes from outside inward to separate the nucleus as we inject into the substance of the lens. This might cause stress in case of harder nucleus where it is difficult to pass the cannula into the lenticular substance and the fluid might get injected in the subcapsular plane and can result in posterior capsular rupture due to unwarranted hydro dissection. So in this method of inside out delineation a central trench is created in the nucleus (grade lll

type of nucleus) followed by the introduction of specially designed right angled cannula to inject fluid perpendicular to the lens fibres from one side of the wall of the trench initially.

As the fluid passes from inside out golden ring can be indicating the completion of the procedure. If the hydro delineation is not complete fluid injection from other side of the wall can be tried. This type of delineation causes less stress on the lens zonules and hence on the posterior capsule. With this method there is direct acess to the central core of the nucleus and also provides an epinuclear shell. Inside out delineation thus over rides the technical difficulty of introducing the cannula in to the lenticular substance in cases of harder nucleus.

Visco dissection

Visco dissection of the epinucleus is done after a hydro free dissection. This method describes the introduction of cyclo spatula in to the anterior capsular and sweeping around the nucleus in all meridional directions[33]. Thus the peripheral part of the nucleus is separated from the epinuclear bowl and limited viscodissection is done to separate the superior nucleus and brought near the rhexis margin and prolapsed in to the anterior chamber with the help of cyclo dialysis spatula working through the side port. Rotation of the nucleus is strictiy avoided in this method also as it can cause sudden rupture of the posterior capsule.

This the method of choosing the right hydro procedure becomes very important during the initial steps of surgery in posterior polar cataract. Though various methods have been described in the literature it is the individual choice and competancy to decide according to the grade of the nucleus and the thickness of the cataract.

Phaco parameters

Slow motion phacoemulsification is recommended in cases of posterior polar cataract according to the various studies. Low phaco parameters are best advised. Low phaco power around 50 to 60%, low bottle height, infusion rate lowered to 15 to 25ml/min and vaccum set around 100mmhg[2,3,34] are the parameters agreed in most of the studies. Low aspiration rate helps to drive the fluid all around the lens whereas low vaccum and infusion rate helps in the maintenance of anterior chamber and hence prevents any turbulence.

Nucleotomy techniques

Using different techniques for emulsifying the nucleus depends on the grade of the posterior polar cataract and also on the density of the nucleus. During the entire emulsification procedure anterior chamber stability is important as sudden anterior tenting can lead to ruptured posterior capsule. Visco elastic substances especially dispersives should be used liberally as when the phaco tip is removed from the anterior chamber. This prevents the

collapse of the chamber. Aggressive and vigorous nucleotomy techniques and cracking of nucleus with an outward movement should be avoided in cases of posterior polar cataract.

- For soft nucleus, nuclear sclerosis of grade 2 or less the entire nucleus can be aspirated within the epinuclear bowl which is acting as a cushion. Emulsification of the nucleus is done by creating adjacent trenches which forms a bowl
- For denser nucleus with nuclear sclerosis of grade >2 step by step chop technique or stop chop or phaco chop can be done. Slow motion phacoemulsification is recommended to prevent any turbulence and hence collapse of the anterior chamber during emulsifying the nucleus. Low phaco parameters are maintained throughout the surgery. Reduced vaccum rate and low bottle height prevents any post occlusion surge.

Various techniques have been described in literature over a period of time for nucleus emulsification in posterior polar cataracts.

- Lambda technique described by Lee and Lee[4] where the nucleus is trenched in the shape of lambda and separated along both the arms removing the distal central piece first. The advantage is this technique does not cause any stress on the capsule and allows slow cracking of the nucleus

- Inverse horse shoe technique in which the nucleus sculpted in this shape and distal end of the nucleus is divided first. Then the two arms are lifted by visco dissection thus the nucleus is surrounded by visco shell. The nucleus can be safely divided in to two without stretching the capsule. Then each piece of nucleus is brought to the centre and emulsified. This technique was described by Salahuddin et al[35] in his study of posterior polar cataract.
- Lim and Goh[36] developed a technique of pre chopping the anterior epinucleus without advancing the chopper to the posterior epinucleus in case of dense nucleus. Thus the dense endonucleus can be mobilized and emulsified. This technique is useful in posterior polar cataracts associated with nuclear sclerosis of > grade 2.
- For harder posterior polar cataracts Chee[37] described a technique of cracking the peripheral nucleus without touching the central core. She chops the peripheral nucleus in to quadrants without rotation. Central core is then engaged with the phaco tip making a cleavage plane along the lenticular lamellae, not reaching the depth, leaving the polar opacity. This is done by using a chopper. Finally the nucleus is removed off from the anterior nuclear shell.
- Bimanual phacoemulsification recommended by Haripriya et al[29] is also very useful as the two incisions almost of same size allows the

interchange of the phaco tip and the irrigation handpiece while emulsifying different parts of the nucleus. Entire nucleus can be emulsified without much manipulation or rotation of the nucleus. Thus the stability of the chamber is also maintained.

- Injection of viscoelastic substance is of primary importance before removing the phaco tip or the hand piece from the main incision or the two side ports, as this dispersive viscoelastic can prevent the collapse of the chamber.

Modified pre chop for dense posterior polar cataract[38]

For management of dense posterior polar cataract, the anterior epinucleus is first pre chopped in piecemeal insitu before mobilizing, segmenting and emulsifying the dense endonucleus. This is followed by the removal of the posterior epinucleus and posterior polar plaque. Because the chopper is repositioned in different meridians in the mid periphery of the anterior epinucleus, it stops short of the central posterior epinucleus, thus avoiding the extension of the crack towards the posterior polar plaque and the posterior capsule.

Management of epinucleus

Epinucleus removal is the most important step and it has to be done methodically to prevent any complications. Various literatures quote different methods of epinuclear removal.

- Vasavada et al[3] suggested stripping of the peripheral part of epinucleus 360 degrees circumferentially by using low phaco parameters. The important thing is that the central part remains attached till the end. Thus cleavage of the epinucleus is done first followed by aspirating it. The part of epinucleus opposite to the main incision is cleaved off with the probe and leaving the central part. Here main idea is just to separate the epinucleus rather than aspirating it. Then the subincisional epinucleus is separated by hydrodissection at multiquadrants with right angled cannula facing right and left. The direction of the fluid wave is thus along the capsule and the lower epinucleus. Doing hydrodissection at this point is safer because the capsular bag is not fully occupied and hence the hydraulic pressure is not sufficient enough to threaten the integrity of the posterior capsule. Aspiration of the epinucleus is done as the final step. This method of layer by layer dissection is found to be useful in eyes with pre existing capsular rent.
- Fine et al[31] used minimal hydrodissection and hydrodelinealtion, nuclear emulsification from within the epinuclear shell and gentle viscodissection of the epinucleus and cortex to avoid unnecessary pressure on the posterior capsule and to protect the region of the greatest potential weakness throughout the procedure

- Allen and Wood[39] also employed a similar method of using viscodissection between the capsule and cortex in low phaco parameters. Rotation of the nucleus is completely avoided in this case. Gentle dissection was done and greater care was taken to protect the weak area of the posterior capsule.
- Nagappa et al[40] described the technique of nucleus removal by phaco aspiration or chip flip method in case of soft nucleus and for harder nucleus direct chop method was employed with very minimal nucleus rotation. Distal epinucleus opposite to the wound is loosened and phaco aspiration is performed for the complete removal of epinucleus. Hydro dissection of the subincisional epinucleus was done to release the adhesions between it and the cortex and finally aspirated. By this method the fluid wave will generate adequate pressure to cleave the weak posterior capsule. Rather the fluid escapes through the path of least resistance in the epinucleus. However this technique is contraindicated in the presence of pre existing posterior capsular dehiscence.
- Taskapili et al[41] showed a significant difference in his result in his study of comparing two groups, one with cortical cleavage and epinucleus removal with and without visco dissection. The epinucleus is viscodissected by sodium hyaluronate 1.4% and then aspirated. In

the group without visco dissection only slow motion phaco was done in low parameters by gently catching the epinucleus and then aspirating it. Posterior capsular rupture was found to be more statistically significant in the non viscodissection group.

- Lee et al[4] managed epinucleus by manual dry aspiration with simcoe cannula.

Surgical technique in the presence of posterior capsular defect

- Layer by layer phacoemulsification technique by Vajpayee et al[42] is recommended best for posterior polar cataract with pre existing capsular defect. Complete hydro delineation is confirmed by the formation of golden ring at the periphery. Central sculpting of the nucleus was done and divided in to two halves with phaco chopper and emulsified within the epinuclear shell. Hence the inner firm nucleus is removed first followed by layer by layer removal of epinucleus and cortex by means of automated bimanual irrigation and aspiration cannula. The cortical matter is gradually separated till 3 to 4mm of the central cortex area. This is done with the help of blunt chopper. The penultimate layer is then carefully aspirated leaving a small area of central posterior plaque with the posterior capsule. Then this central plaque is carefully viscodissected. This method of

mechanical separation of the epinucleus layer by layer avoids any traction which is otherwise exerted by direct removal epinucleus.

In case of patient with familial type of posterior polar cataract with pre existing posterior capsule defect attempts have been made to convert the posterior defect in to posterior capsulorhexis with the help of uthrata forceps. Sufficient viscoelastic should be injected to push the anterior hyaloid face. High viscosity sodium hyaluronate have been used for this purpose.

If the posterior polar cataract is found to be associated with dense subcapsular cataract, then the posterior plaque can be carefully peeled off after a posterior edge is defined. If the dense plaque could not be removed intraoperatively and has a sufficient potencial to decrease the vision then a posterior capsulorhexis can be performed at this stage[43]. Residual capsular opacification can be cleared by YAG cap at one month postoperative period. Some literatures also quote staining of the epinucleus and the remaining opacity with intracameral dilute fluorecein dye which helps in the careful aspiration of the epinucleus without damaging the posterior capsule[44]. But this could be dangerous if the dye percolates downwards in to the vitreous in unwarranted posterior capsular rupture.

Cortex removal

Bimanual automated aspiration with low power and low aspiration parameters is considered safe for the removal if cortex. The pulling of the cortical material should be tangential rather than towards the centre. The aspiration tip should be kept at the equatorial angle until the suction is increased and the cortex is aspirated. Coaxial method have also been tried by Fine et al[31]. Alternatively dry aspiration of the cortex can also be done after filling the chamber with sufficient viscoelastic

Pseudohole

A circular defect in the posterior cortex may appear as a hole after the removal of the last piece of nuclear fragment. It is most often difficult to distinguish whether the hole is a true or a pseudo hole. A blunt cannula tip can be placed to feel the capsule in such cases. If a vitreous strand is noticed then it has to be sufficiently managed by vitrectomy. In case of peudohole gentle viscodissection can be done after pushing the anterior hyaloid face.

Polishing of the posterior capsule

Polishing of the posterior plaque should be completely avoided in case of posterior polar cataract as the capsule is very thin at this area and can easily give away causing a rupture. Minimal residual aspiration technique used by Osher et al[2] recommends the depressing and releasing of the foot pedal as the posterior plaque touches the irrigation aspiration tip.

The vaccum created by this manuovre is sufficient to clean the posterior capsule with minimal risk.

Removal of posterior plaque

Removal of posterior polar opacity should be done at the end of the cortical aspiration for fear of posterior capsular rupture. Viscodissection can be done and aspirated slowly either with phaco tip or aspiration irrigation cannula[41]. Alternatively the plaque can dislodged with a hook and removed with forceps after filling the anterior chamber with sufficient viscoelastic substance.

Anterior vitrectomy

Posterior capsular dehiscence is a well known complication associated with cases of PPC. The signs like sudden deepening of the anterior chamber and appearance of a bright red reflex, difficulty in the aspiration of the cortex, lateral displacement of the nucleus or the nucleus does not follow the phaco tip should be taken as a clue of capsular tear. Once the tear is identified sufficient viscoelastic should be injected before removal of the tip from the incision site. This prevents the sudden upthrust of the anterior vitreous face.

In case of posterior tear two port vitrectomy is advised by vasavada et al[3]. Low vaccum and high cutter rates are recommended. High viscosity sodium hyaluronate is injected to plug the posterior capsule. The vitrector

should never be placed behind the peripheral torn capsule. Direction of the infusion cannula should be towards the peripheral anterior chamber and the flow of the fluid is directed away from the defect. This reduces the anterior chamber turbulence and also the hydration of the vitreous. Unnescessary enlargement of the tear can be avoided by this method. In the layer by layer phacoemulsification described by Vasavada[32] a vertical posterior capsular defect was found in all eyes with intact vitreous face. Hence anterior vitrectomy was not performed in any of his cases.

Intraocular lens implantation

Placement of an IOL depends on whether the posterior capsule is intact or not. If there is no intraoperative complication and capsule is intact, a single piece IOL can be safely placed in the bag. In case of small defect in the capsule without vitreous disturbance, posterior circular capsulorhexis (PCC) can be performed and the intraocular lens can still be implanted in the bag. Trailing haptic should be compressed while placing the IOL. Rotation of the capsular bag should be avoided under any circumstances which might cause undue stress resulting in the capsular tear.

Mackool suggested Polymethyl metha acrylic IOL in case of PPC as this type of IOL opens inside the capsular bag without causing stress on the zonules[13]. He also devised the technique of tying the haptics with 10-0

nylon sutures and cutting it after placing the lens in the bag. This causes the initial compression of the IOL.

In case of large capsular tear, a multipiece IOL has to be implanted in the ciliary sulcus with or without optic capture (Rhexis fixated IOL). The purpose of an optic capture in the anterior capsulorhexis helps in the stability of the IOL and hence positioning of the lens in the centre. A high viscosity substance like provisc or hyvisc is used for this purpose. In larger tear where sufficient support is not available, the haptics can be sutured to iris or to sclera and fixation of the intraocular lens can be done.

Wound closure

Anterior chamber might collapse while removing the viscoelastic with irrigation aspiration tip, hence an AC maintainer is kept or continous fluid flow is maintained through the side port till the viscoelastic substance is removed and the wound integrity is checked. The paracentesis can be sutured to prevent any micro leak and hence tight wound closure.

Posterior segment approach

Parsplana vitrectomy and lensectomy might be useful in posterior polar cataracts with larger plaques (>4mm)[26]. A three port pars plana vitrectomy has also been recommended in cases of posterior polar cataract[45]. In this approach either iris supported or sclera fixated IOL's can be fixed either at the same sitting or at a later stage.

Ghosh and Kirkby[45] have done this technique in eight patients where they used a 19-gauge winged metal infusion cannula ('butterfly') as an infusion line directly into the crystalline lens and either the vitreous cutter or fragmatome or both (depending on nuclear sclerosis) used to remove the lens. In all cases some lens fragments were dislocated posteriorly that were removed later by central vitrectomy. In the middle of the procedure, if anterior capsular opacified, the vitreous cutter in suction mode would be used to polish it from posteriorly with later central anterior capsulectomy by the vitreous cutter. Foldable sulcus intraocular lens is implanted

Complications in Posterior polar cataract

Other intraoperative complications include,

- Spontaneous capsular rupture either unilaterally or bilaterally[46,47]
- Posterior dislocation of lens in to the vitreous cavity (Nucleus drop). This can occur either due to big tear in the capsule or spontaneously due to increased growth of the lens associated with nuclear sclerosis. Increased pressure of the posterior capsule with the thickness of the lens might cause this dislocation.
- Vitreous loss
- Retinal detachment
- Macular edema, commonly seen in cases of posterior capsular rent[42]

- Amblyopia, seen in case of congenital cataracts gives an unsatisfactory visual outcome even after surgery[48]
- Residual opacity which needs postoperative YAG capsulotomy.

AIM

To report the surgical and visual outcome and to assess the risk factors for posterior capsular rupture in posterior polar cataracts

OBJECTIVES

1. To describe the surgical procedure used
2. To describe the intraoperative complication and the stage at which it occurred.
3. To document the postoperative visual outcome
4. To document any postoperative intervention done(if needed)

MATERIALS AND METHODOLOGY

STUDY DESIGN

A Prospective study of 100 individual eyes, who presented to Aravind Eye Hospital, Madurai with posterior polar cataract.

STUDY PERIOD

January 2012 to June 2012

PATIENT SELECTION CRITERIA

INCLUSION CRITERIA

- Eyes with typical posterior polar cataract
- Posterior polar cataract associated with nuclear sclerosis, posterior subcapsular cataract

EXCLUSION CRITERIA

- Any combined procedures
- Eyes with Corneal opacity
- Eyes with glaucomatous damage
- Any coexisting retinal pathology
- Paediatric cataract
- Any ocular pathology impairing vision other than cataract

METHODOLOGY

The medical records of the patients diagnosed with posterior polar cataract and underwent surgery in Aravind Eye Hospital, Madurai between the time period of January 2012 to June 2012 were reviewed and included in the study. 100 individual eyes were identified and selected according to the inclusion criteria.

Preoperative

The following data such as age, sex, visual symptoms, eye to be operated, pre operative uncorrected and best corrected visual acuity using snellen's chart were recorded. A detailed slit lamp biomicroscopy including thorough anterior segment examination, type of posterior polar cataract if associated with nuclear sclerosis or posterior subcapsular opacity or presence of pre existing capsular defect, dilated fundus examination, intraocular pressure, A-scan and keratometry using IOL master were performed in all patients.

Intraoperative

Type of surgery, intraoperative complication, surgical step at which the complication occurred, if any intervention done, type of IOL placed, presence of any residual plaque or primary capsular opacity were noted.

Postoperative

Post operative visual acuity on day 1, 1 month and 6 month follow up were recorded. During each visit both uncorrected and best corrected visual acuity using snellen's chart was recorded. Post operative complication following surgery if any was noted.

Surgical technique

All the surgeries were done by equally experienced surgeons. Surgical procedure includes both small incision cataract surgery and phacoemulsification. All the surgeries were performed under retrobulbar anaesthesia.

For manual small incision cataract surgery, a 6mm incision was made in the external scleral part and side pockets were made on both sides. Internal corneal lip was made with keratome. Anterior chamber was filled with viscoelastic to maintain chamber stability. Continuous curvilinear capsulorhexis of size 7mm was made in all case with the help of cystitome (26 gauge bent needle) Hydrodelineation was performed in all cases. Hydro dissection was avoided as it can cause unwarranted posterior capsular rupture or can extend a pre existing one. Separation of central nucleus from epinucleus was done. Nucleus was delivered by irrigating wire vectis method. Epinucleus was removed by careful visco dissection. Irrigation and

aspiration of the cortical matter was done initially in the periphery and then the central part taking care of the polar opacity. Posterior plaque adherent to the capsule was carefully visco dissected. Rigid PMMA lens of optic size 6mm was placed in bag in all cases. In cases where there was posterior capsular rent occured bimanual automated vitrectomy was done and a three piece PMMA IOL (Poly methylmetha acrylate) was placed safely in sulcus or in the bag according to the availability of support intraoperatively.

In Phacoemulsification, clear corneal tunnel of 2.8mm was made in all cases. Two side port incisions were made two clock hours away to the main incision. Visco surgical device was used for anterior chamber stability. Anterior chamber turbulence was kept minimum and central curvilinear capsulorhexis of size 5mm was performed in all cases with 26 gauge bent needle. Cortical cleavage hydrodissection was avoided and hydrodelineation was done by injecting small quantity of fluid in multiple quadrants done in all cases. Thus the core nucleus was delineated from the epinucleus. Rotation of the nucleus within the capsular bag was avoided. Epinucleus acts as a cushion protecting the posterior capsule.

Slow motion phacoemulsification was done in all cases. The phaco parameters used were 250 to 300mmHg vaccum, 50% power. Nucleus emulsification was done at an increased 300 to 350mmHg vaccum depending on the grade of the nucleus using same power. Throughout the

procedure the bottle height was kept at 100cm with irrigation flow rate was maintained around 26mL/min. For soft cataracts minimal power was used and nucleus was aspirated using vaccum or alternatively chip and flip method was used. In case dense nuclear sclerosis phaco chop/ direct chop was the preferred technique and posterior placement of chopper tip was avoided. Posterior adherent plaque was approached at the end of cortical aspiration. Bimanual automated Vitrectomy was done in cases of posterior capsular rupture. Acrylic IOL (Alcon surgical SA 60AT) placed in the bag except in case of rent where three piece Acrylic IOL was implanted.

Post operatively all the patients received topical steroid antibiotic combination for two weeks and then only steroid eye drops was given in tapering dosage.

Statistical analysis

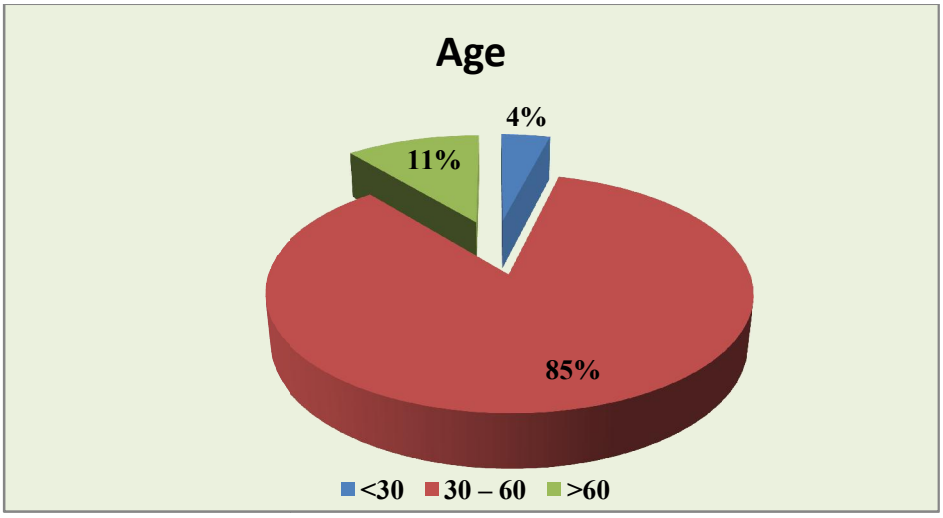
Statistical analysis was done using STATA 11.0 and Microsoft excel sheet. All the variables were entered and frequency and percentage was calculated. Intraoperative complication was analysed by chi-square test. Visual acuity was analysed in Log MAR using Wilcoxon signed rank sum test for pre and post comparison and Mann- whitney U test for group comparison. Fisher's exact test was used for the analysis of status of vision. P-value < 0.05 was considered statistically significant.

RESULTS

DEMOGRAPHIC PROFILE

AGE

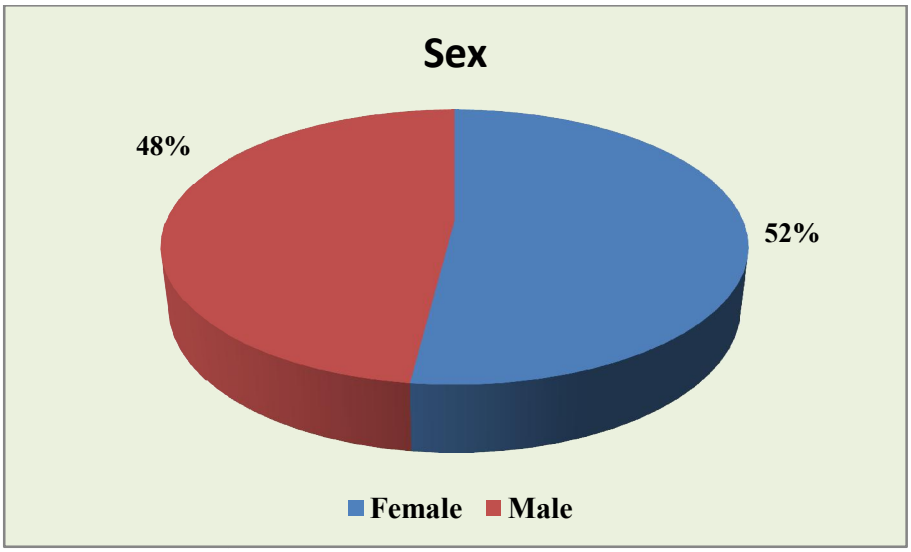
Out of the 100 patients, 85 cases belong to the age group between 30 to 60 and 11 cases were in the age group above 60. Only 4 patients were below 30 years.



Age category	n	%
<30	4	4
30 – 60	85	85
>60	11	11
Total	100	100

The youngest patient presented was 20 years and the oldest patient was 70 years.

GENDER DISTRIBUTION

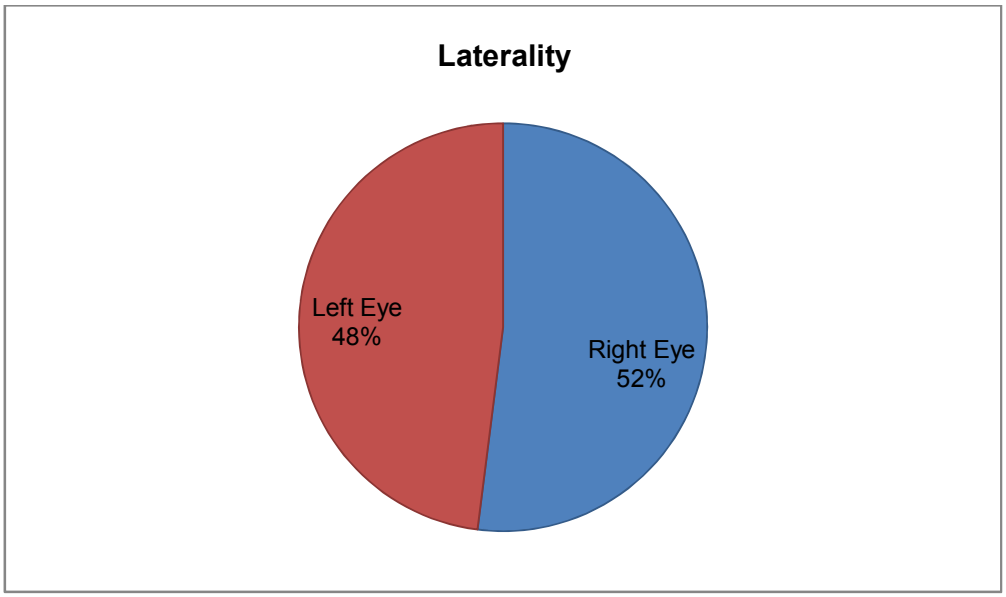


Sex	n	%
Female	52	52
Male	48	48
Total	100	100

Gender distribution showed almost equal number of male and female

Patients.

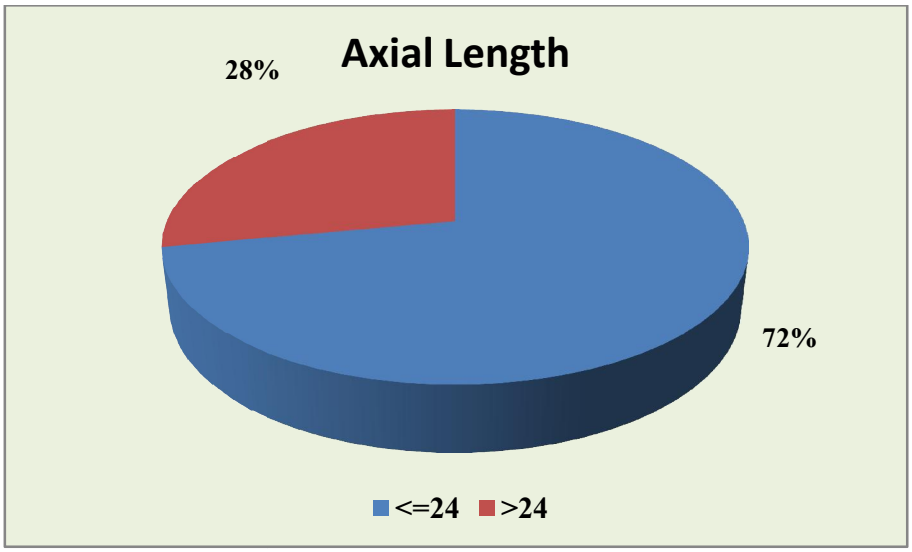
LATERALITY



Our patients showed almost equal presentation of right eye (52%) and left eye (48%).

Laterality		
Eye	**Frequency**	**Percentage**
Right	52	52
Left	48	48
Total	100	100

AXIAL LENGTH



Axial length	n	%
<=24	72	72
>24	28	28
Total	100	100

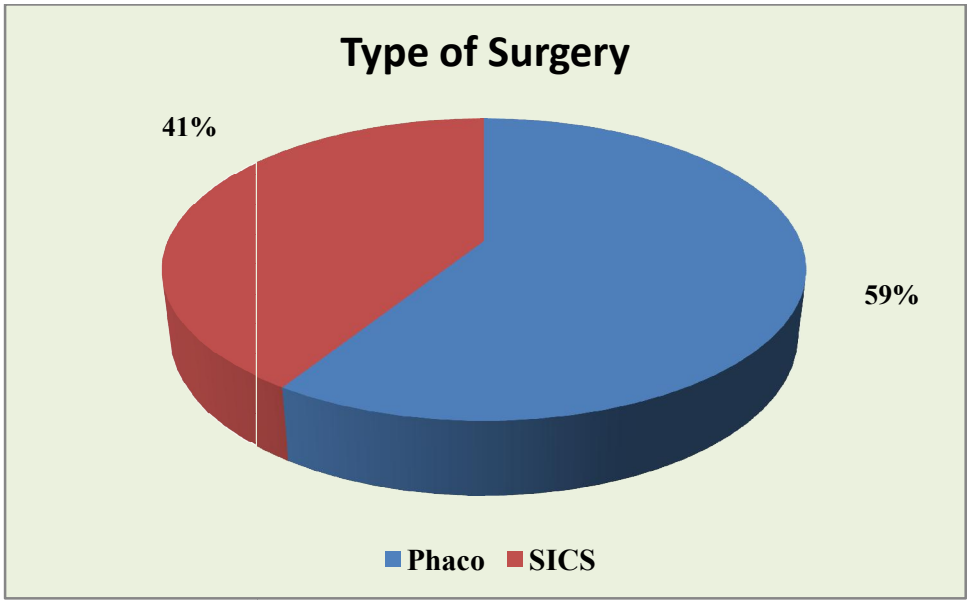
TYPE OF POSTERIOR POLAR CATARACT

Type	Frequency	Percentage
PPC	71	71
PSCC with PPC	4	4
NS with PPC	23	23
PPC with PCD	2	2
Total	100	100

Out of 100 cases, Posterior polar cataract was also seen in association with Posterior subcapsular cataract (4%), with nuclear sclerosis (23%) and 2% of the cases was associated with pre existing posterior capsular dehiscence.

TYPE OF SURGERY

Modalities of surgery include both phacoemulsification and manual small incision cataract surgery. 41% of patients underwent Small incision surgery and in 59% patients Phacoemulsification was done.



Type of surgery	n	%
Phaco	59	59
SICS	41	41
Total	100	100

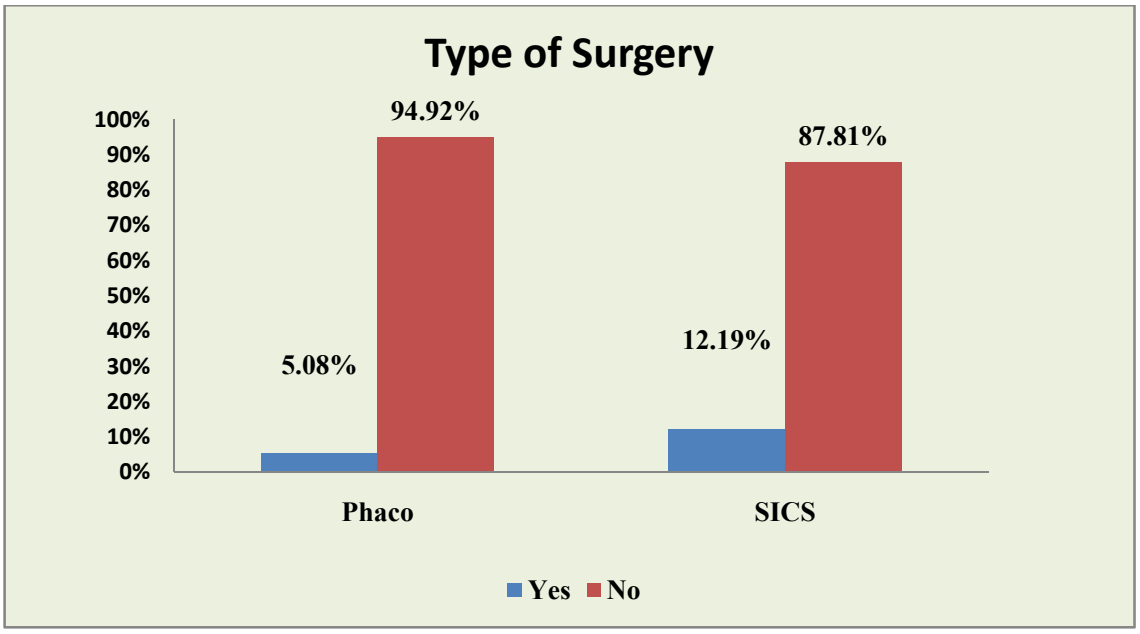
INTRAOPERATIVE COMPLICATION

Complications	Type of surgery		Total (n=100)
	Phaco (n=59)	*SICS (n=41)*	
No complication	56(94.91)	36(87.8)	92
Complication			
PCR	2(3.38)	4(9.75)	6
PC dehiscence	1(1.7)	1(2.4)	2

Complications	Type of surgery		n	P-value*
	Phaco	SICS		
Yes	3(5.1)	5(12.2)	8	0.267
No	56(94.9)	36(87.8)	92	
Total	59	41	100	

*chi-square test

INTRAOPERATIVE COMPLICATION



Posterior capsular rupture was the most common complication and it was seen in 8% of the cases. Out of 8, 3 cases occurred in phacoemulsification and the remaining 5 cases were observed in SICS. 2% (2 out of 8) cases had pre existing capsular dehiscence.

RESIDUAL PCO

Residual PCO	Type of surgery		n	P-value*
	Phaco	SICS		
Yes	3(5.1)	1(2.4)	4	0.642
No	56(94.9)	40(97.6)	96	
Total	59	41	100	

Residual plaque/ PCO were seen in 4% of the cases with a p value of 0.642, which is not significant. These cases were managed with Yag capsulotomy postoperatively at 6 months follow up.

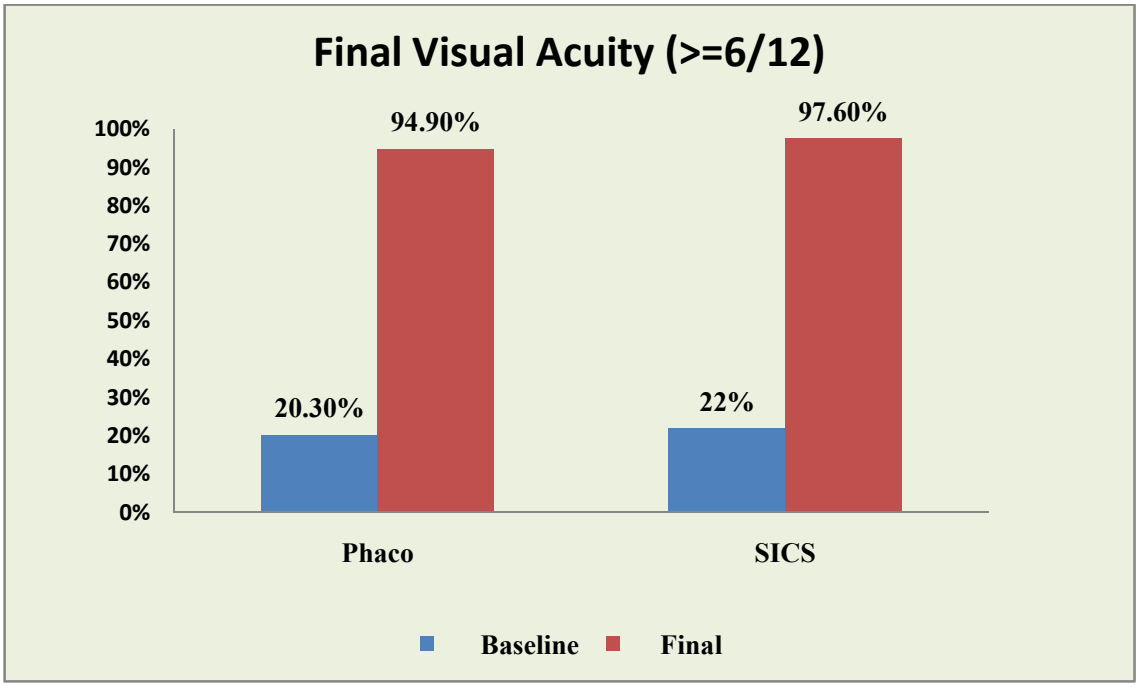
POSTOPERATIVE VISUAL ACUITY

Type of surgery	Median Snellen equivalent	LogMAR(BCVA) Mean(SD)	Min-max	P-value*	P-value#
Phaco					
Baseline	6/18	0.47(0.31)	0 – 1.78	-	0.372
Day1	6/9	0.18(0.17)	0 – 1	<0.001	0.0003
Month1	6/6	0.06(0.14)	0 – 0.78	<0.001	0.0010
Month6	6/6	0.05(0.13)	0 – 0.78	<0.001	0.0003
SICS					
Baseline	6/12	0.42(0.28)	0 – 1.78	-	
Day1	6/12	0.28(0.12)	0 – 0.48	0.0003	
Month1	6/9	0.12(0.10)	0 – 0.3	<0.001	
Month6	6/9	0.10(0.10)	0 – 0.3	<0.001	
Total					
Baseline	6/18	0.45(0.29)	0 – 1.78	-	
Day1	6/9	0.22(0.16)	0 – 1	<0.001	
Month1	6/6	0.08(0.12)	0 – 0.78	<0.001	
Month6	6/6	0.07(0.12)	0 – 0.78	<0.001	

*Wilcoxon signed rank sum test (pre and post comparison)

Mann-whitney U test (Between group comparison)

Visual acuity	Type of surgery	
	Phaco	***SICS***
Baseline		
>=6/12	12(20.3)	9(22.0)
<6/12	47(79.7)	32(78.0)
Final		
>=6/12	56(94.9)	40(97.6)
<6/12	3(5.1)	1(2.4)



STATUS OF VISION

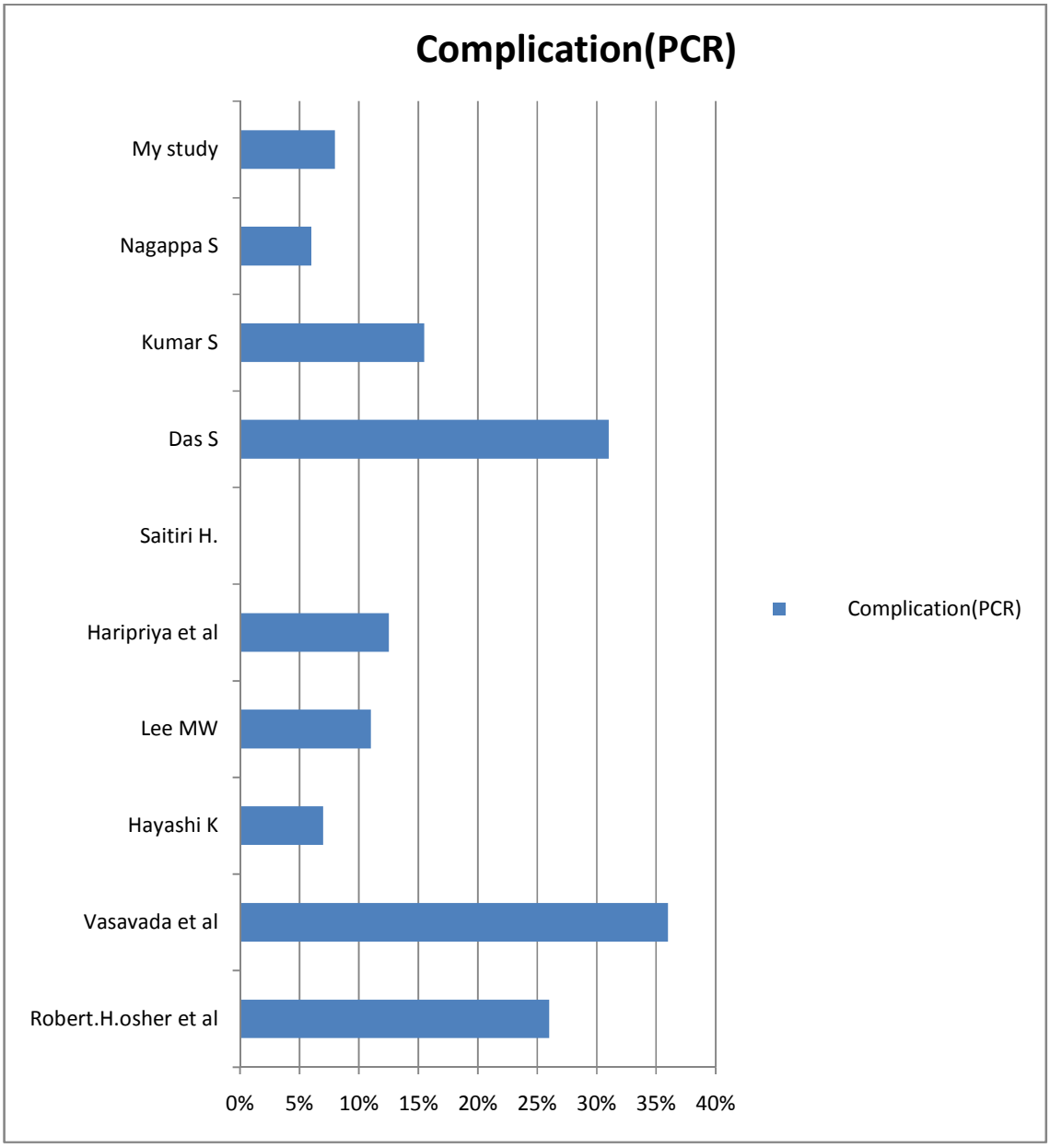
Status	Type of surgery		n	P-value*
	Phaco	SICS		
Improved	59(100.0)	40(97.6)	99	0.410
Same	-	1(2.4)	1	
Total	59	41	100	

*Fisher's exact test

Among the 100 eyes operated, 99 eyes showed improvement in the visual acuity postoperatively after a follow up period of 6 months. 1 case stayed the same because of marked amblyopia.

COMPARISION STUDIES

Authors	Complication(PCR)
Robert.H.osher et al	26%
Vasavada et al	36%
Hayashi K	7%
Lee MW	11%
Haripriya et al	12.5%
Saitiri H.	0%
Das S	31%
Kumar S	15.5%
Nagappa S	6%
My study	8%


Complication(PCR)
My study
Nagappa S
Kumar S
Das S
Saitiri H.
Haripriya et al
Lee MW
Hayashi K
Vasavada et al
Robert.H.osher et al
0%
5%
10%
15%
20%
25%
30%
35%
40%
Complication(PCR)

DISCUSSION

Cataract surgery in posterior polar cataract can be quite challenging to the anterior segment surgeon. Because of its predisposition to cause posterior capsular rupture and also other related complications like nucleus drop, modified surgical techniques have to be tried. Posterior polar cataract is described as a type of developmental cataract which can affect the quality of vision quite early compared to other types of cataracts.

In this study the age of the patients were ranging from 20 to 65 years with majority of the patients in the age group between 30 to 60 years (85%). This clearly indicates that posterior polar cataract is the cataract of relatively younger age group. Young age patients often present with complaints of glare, photophobia and difficult night driving and visual acuity is grossly impaired in later stage especially when PPC is associated with posterior subcapsular opacity or with nuclear sclerosis. Another reason for the early presentation in polar cataract is the increase in the awareness among the patients. There is no sex predilection for posterior polar cataract in general. This study also shows almost equal number of male and female patients.

Management of posterior polar cataract though controversial earlier is now clearly established. As most of these cases present before the development of nuclear sclerosis, the surgical technique should mainly

involve the effective management of soft nucleus and to protect the posterior capsule.

In this study out of 100 eyes 59 eyes underwent phacoemulsification and the remaining 41 eyes had small incision cataract surgery. Closed chamber technique is much preferred than the conventional Extra capsular extraction as the nucleus delivery can be very traumatic in extra capsular extraction and there is no intact capsulorhexis available for placing the intraocular lens in case if rent occurred. Literature review reveals a higher complication rate in extra capsular cataract extraction (ECCE) [33]

Thorough knowledge about the surgical anatomy and the basic principles of surgery in case of Posterior polar cataract is important. As the average lens thickness in posterior polar cataract is less compared to the senile cataract, also there is no clear demarcation between the posterior plaque and the capsule, manoeuvres like hydrodissection and nuclear rotation in the capsular bag can open up the capsule or can enlarge the existing one. Maintaining the stability of the anterior chamber and not causing any undue pressure on the capsule can help in preventing posterior capsular rupture.

During the surgical procedure, the posterior part of the cataract where the plaque is situated should not be disturbed till the end of cortical

aspiration. Certain basic guidelines remain common for both phacoemulsification and small incision surgery

- Adequate size of the central curvilinear capsulorhexis (about 5 to 5.5mm) should be performed.
- Continuous low mode irrigation or an AC maintainer or adequate viscoelastic substance should be used to avoid anterior chamber turbulence. Increase in hydraulic pressure and the forward movement of the capsular complex can thus be minimized.
- Hydrodelineation is performed in all cases. Injecting minimal amount of fluid in multiple quadrants can be performed to reduce the stress on posterior capsule. Any sudden increase in intra lenticular pressure should be avoided
- Gentle compression of the nucleus after the hydro procedure followed by slow separation of nucleus from the epinucleus done to reduce the pressure on posterior capsule.
- Rotation of nucleus within the capsular bag should be avoided.
- Low phaco parameters and reduced bottle height maintained throughout the surgical procedure.

In small incision cataract surgery the importance lies in mastering the technique of hydro delineation thus separating the core nucleus from

epinucleus, prolapsing the nucleus in to the anterior chamber and delivery of the nucleus through the sclerocorneal tunnel.

Phacoemulsification gives a better control of closed chamber technique in managing posterior polar cataracts. In most of the cases the patients are young and the nucleus is soft, it can be aspirated easily without the actual need of emulsification. Stripping of the epinuclear shell from the cortex should be gently done. Peripheral cortical fibres are aspirated first before reaching the central part. Basic understanding of phacodynamics is necessary to ensure the safety of the procedure.

In our study, chip and flip method was most commonly used for soft cataracts and direct chop/ phaco chop was performed for hard nucleus (Nuclear sclerosis more than grade 2). The nucleus was gently emulsified with low power settings and the peripheral cortex was pulled out by slow irrigation and aspiration. In most of the cases the posterior opacity peeled spontaneously probably due to reduced infusion pressure. Cortical fibres present over the posterior polar region was preserved till the last piece emulsification. Masket[13], in his study also recommended this technique to prevent lens drop in to vitreous in case of unexpected posterior capsular rupture.

The most common intraoperative complication encountered in this study is posterior capsular rupture, accounting for about 8% of the total 100 cases. Of these 3% underwent phacoemulsification and the remaining 5% had small incision cataract surgery. 2 cases out of these 8 (2%) cases had pre existing posterior capsular dehiscence. In phacoemulsification group the capsular rupture occurred mostly while emulsifying the nucleus and in SICS 3 out of 5 cases the rent occurred during epinucleus removal which was noticed after the nucleus delivery, 2 cases had a rupture during cortex aspiration.

Adequate viscoelastic substance was injected to push the anterior vitreous face and to plug the posterior capsular rent. Anterior chamber stability was maintained. Dry aspiration of the cortex was done to prevent further traction of the vitreous. In all the cases bimanual automated anterior vitrectomy was done and a 3 piece intraocular lens was placed either in the bag or in the sulcus according to the availability of the support.

Residual posterior capsular opacity was seen in 4 cases (4 out of 100) in this study. Though in most cases the posterior opacity separated easily, these 4 cases had posterior plaque strongly adherent to the posterior capsule. Further manipulation was not done for the fear of capsular rupture and complications. Hence the residual posterior plaque was left intraoperatively in all these cases and Nd-Yag capsulotomy was done at a later stage during

the follow up at 6 months. Patients were explained about the delayed visual recovery and counselled about the procedure.

All these cases with residual opacity had dense polar opacity observed during the pre operative slit lamp examination. Posterior capsulorhexis as described by few studies was not performed in these cases[41]. Posterior rhexis has been described as a safe method to remove the residual plaque and also to reduce further retinal complications[41]. But in our study all the cases had Nd Yag capsulotomy at 6 months follow up and regained good vision.

Final visual acuity improved significantly in majority of the cases (>=6/12) in 94.9% in phacoemulsification group and 97.6% in the SICS group with the p-value of <0.001which is statistically significant when compared to the baseline vision. In one case the status remained same due to dense amblyopia which was explained to the patient.

Posterior capsular rupture in posterior polar cataracts have been reported as the most common complication in almost all the studies conducted so far. The incidence have been as high as 36% reported by Vasavada et al[3] , 26% by Osher et al[2], 31% by Das et al[33] and so on. In contrast the incidence of capsular rupture in this study was found to be 8%. This lower incidence could be due to few reasons.

- Careful preoperative examination to assess the type and degree of cataract
- Documenting the signs of pre existing PCD such as presence of white dots on the posterior capsule and in anterior vitreous face, thick margins of the capsular defect and fish tail sign.
- Preparation of the patient and proper preoperative councelling regarding the nature of the cataract
- Understanding phacodynamics and modification in the parameters according to the type of cataract.
- Awareness of the weak posterior capsule and careful handling throughout the surgical procedure.
- Maintenance of chamber stability and use of bimanual vitrectomy if needed.

Few others have suggested modification of surgical techniques like layer by layer phacoemulsification by Vajpayee et al[40], gentle viscodissection by Allen and wood[37]. Most commonly posterior capsule rupture noticed either during nucleus rotation/ emulsification or during the epinucleus removal.

CONCLUSION

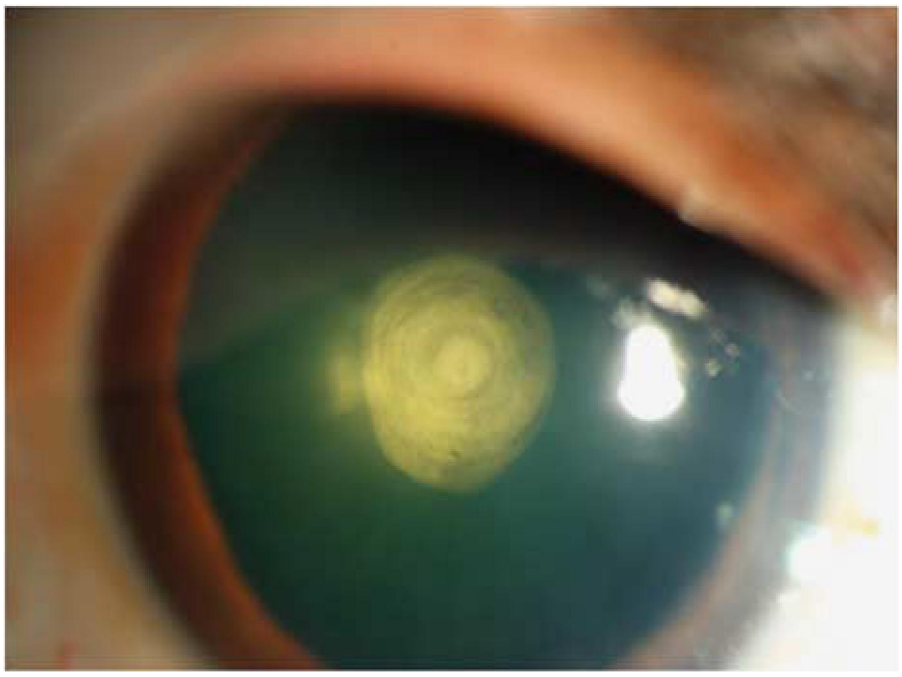
In this prospective study of posterior polar cataracts,

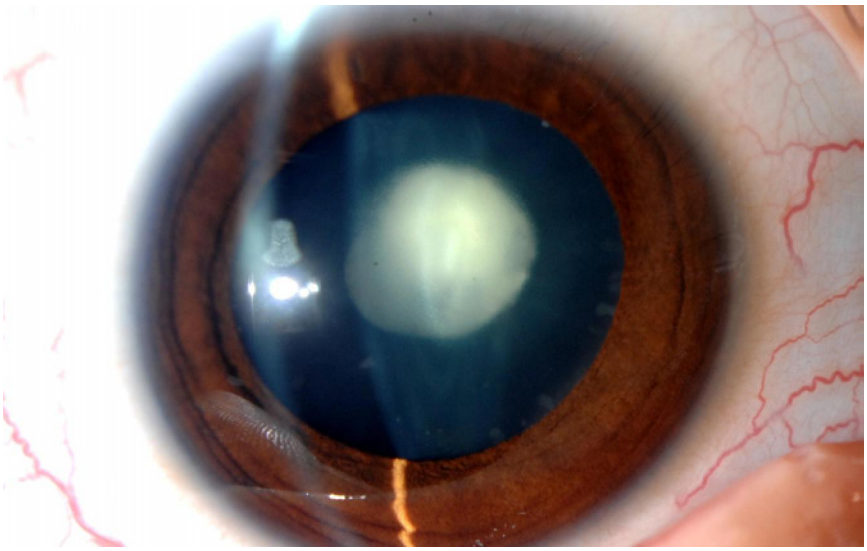
- The mean age of presentation was 47 years with majority of the patients below the age of 50 years
- Most common symptom in younger age group of patients was glare and difficult night driving
- Most common intraoperative complication was Posterior capsular rupture accounting for about 8% of the cases. This can be attributed to the modified surgical technique and awareness of the weak posterior capsule
- Residual posterior capsular plaque was seen in 4% of the cases which was managed with Nd- Yag capsulotomy postoperatively
- Postoperative vision had significantly improved when compared to the baseline vision except for 1 case which stayed the same due to marked amblyopia

Though the management of posterior polar cataract poses challenge even for experienced surgeons, choosing a closed chamber surgical procedure, achieving a good capsulorhexis, adoption of certain modified surgical techniques which causes minimal stress on the zonules and on the posterior capsule, removing the central epinuclear shell as a last part of

cortical clean up carefully, avoiding nucleus rotation, posterior capsule polishing can result in favourable surgical outcome. Though the surgical technique may vary with each individual surgeon, special attention paid to these details can help during the procedure and result in the safe outcome. Preoperative counselling of the patient and explaining the complications expected is mandatory. In the event of any complication or breach in posterior capsule adequate follow up of the patients is necessary.

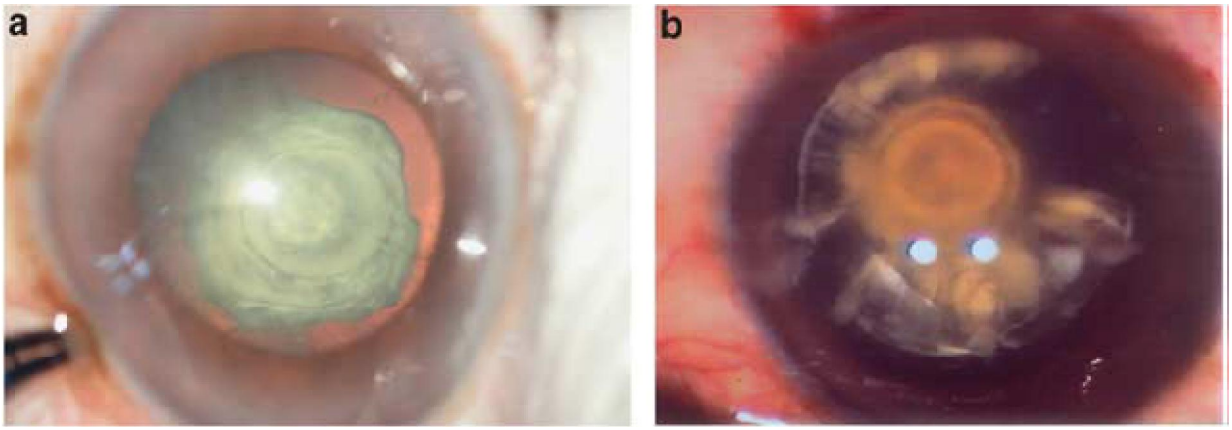
TYPICAL POSTERIOR POLAR CATARACT- CENTRAL DISK SHAPED OPACITY GIVING BULL'S EYE APPEARANCE



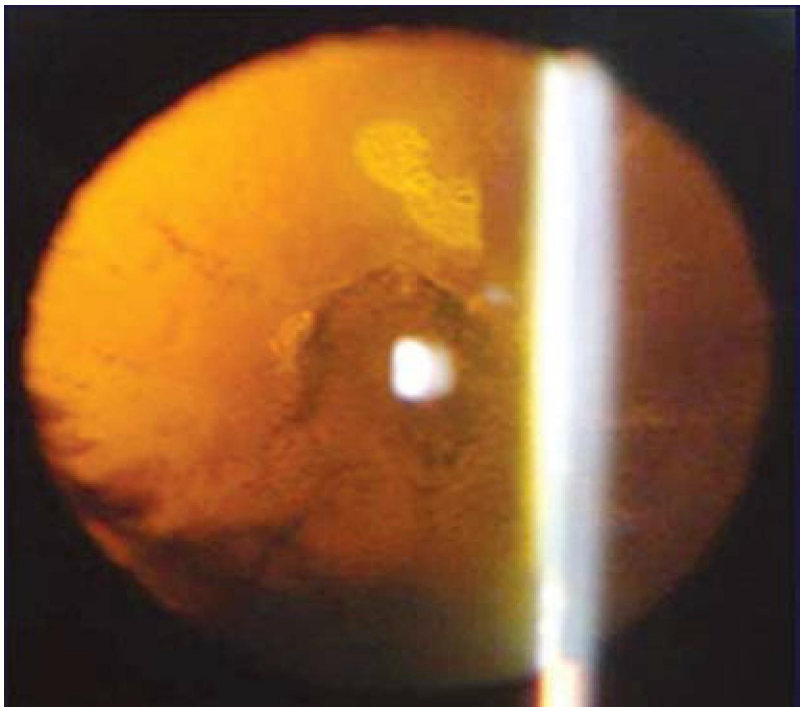


PROGRESSIVE TYPE OF PPC

PICTURE SHOWING RADIATING RIDER OPACITIES(a, b)



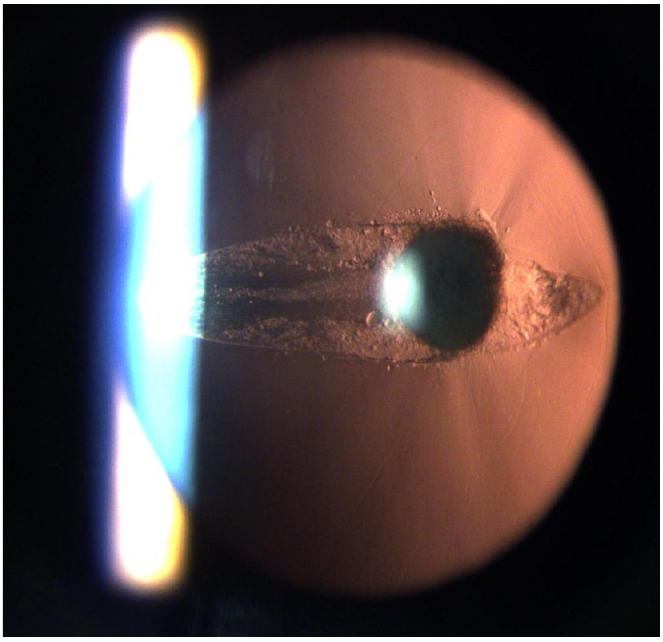
PPC ON RETROILLUMINATION



POSTERIOR POLAR CATARACT WITH PRE EXISTING

CAPSULAR

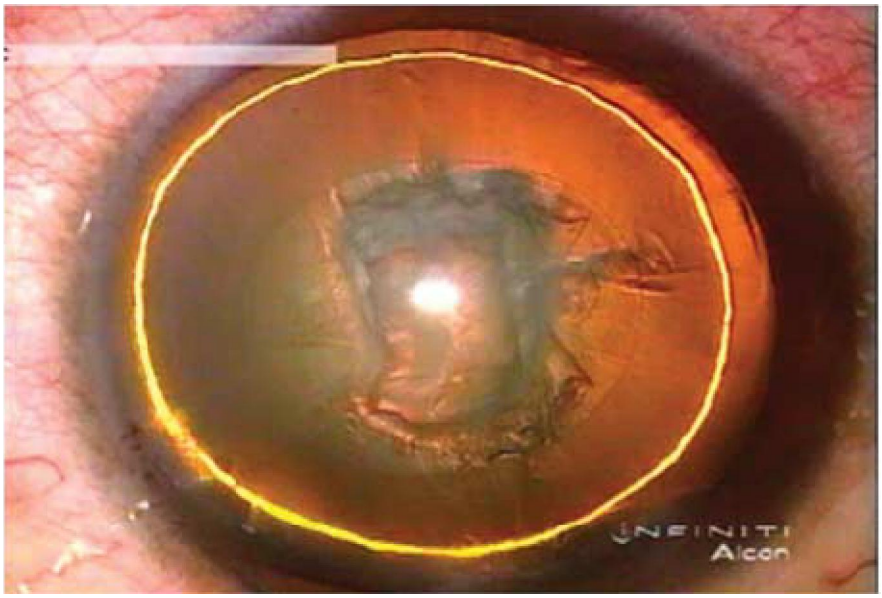
DEHISCENCE (a)



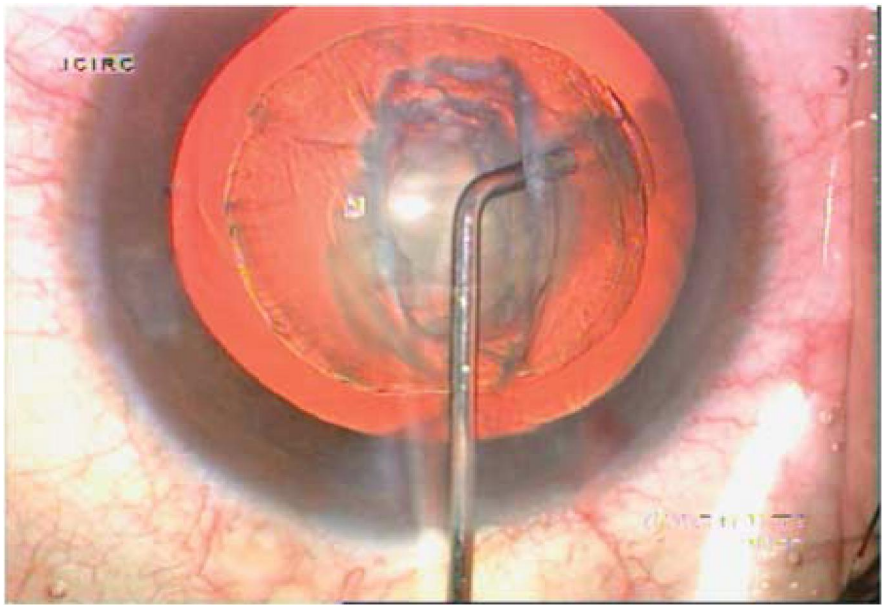
ON RETROILLUMINATION

APPEARANCE OF GOLDEN RING IN TYPICAL

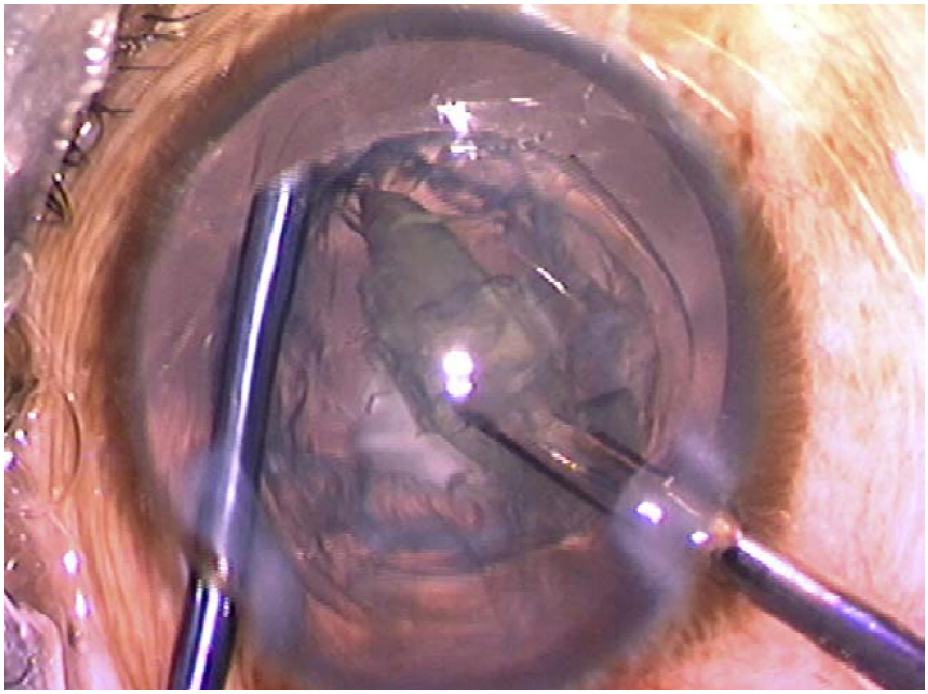
HYDRO DELINEATION

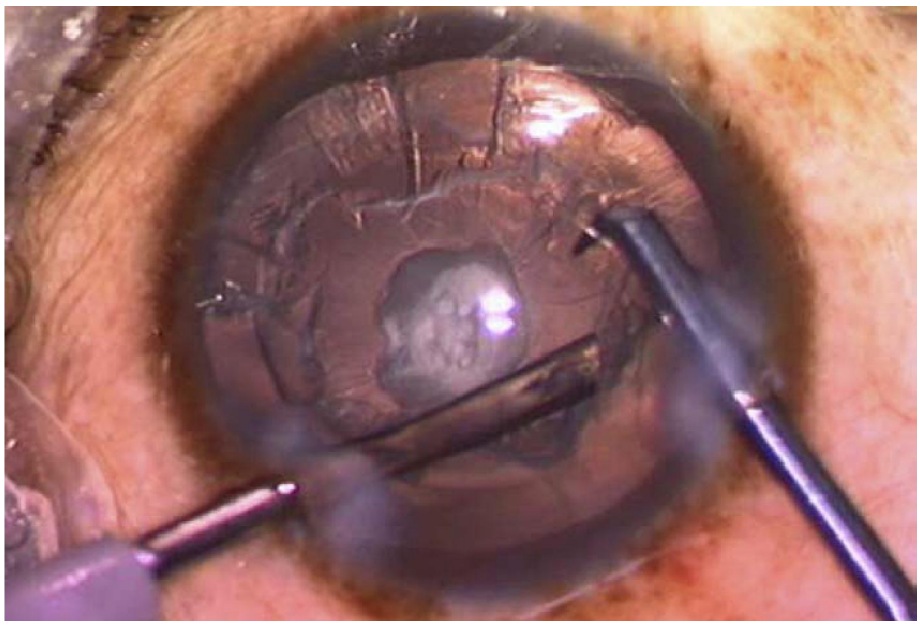


TECHNIQUE OF INSIDE-OUT DELINEATION

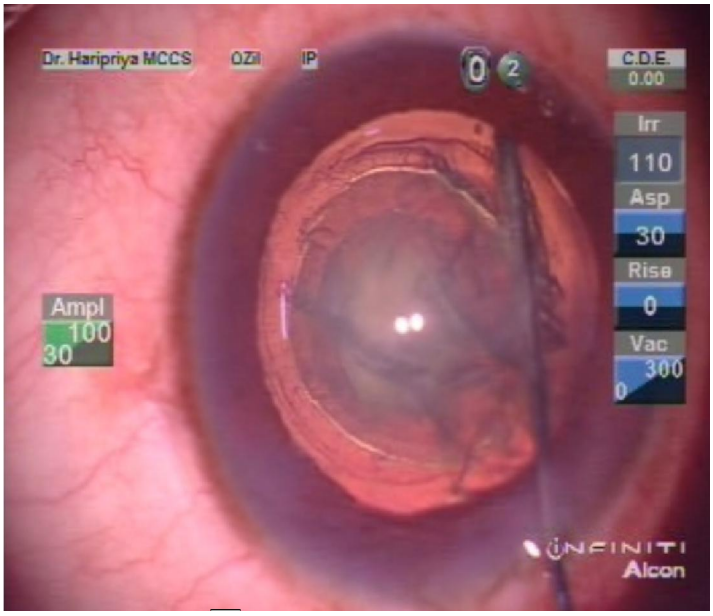


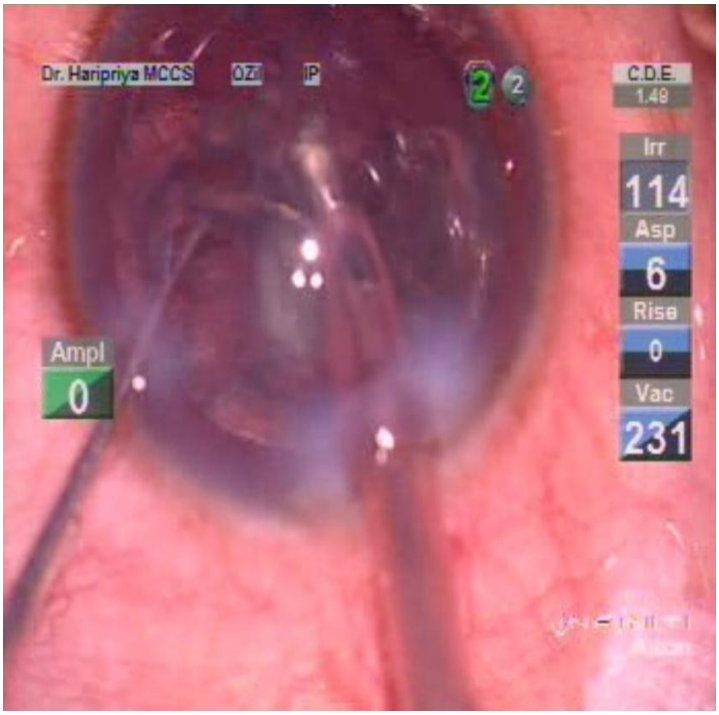
BIMANUAL MICRO PHACOEMULSIFICATION





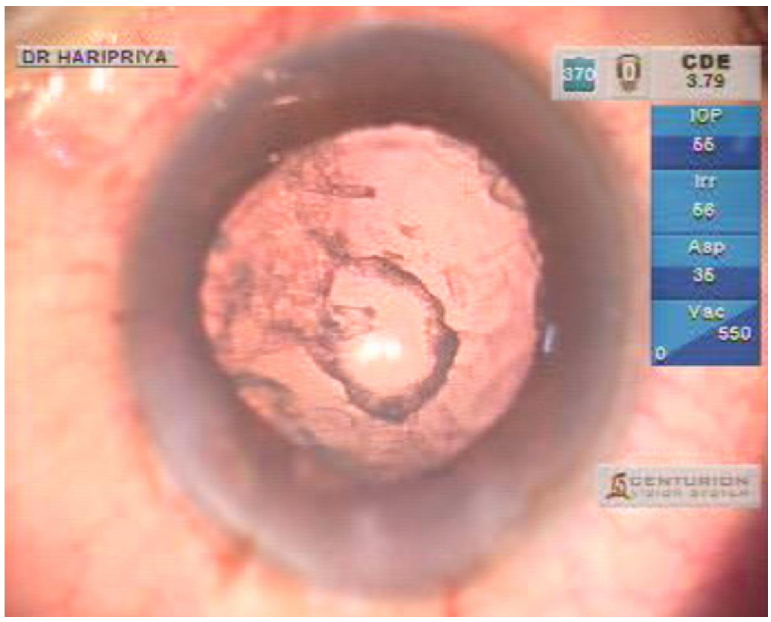
MANAGEMENT OF EPINUCLEUS- CLEAVING BY MULTIQUADRANT DISSECTION



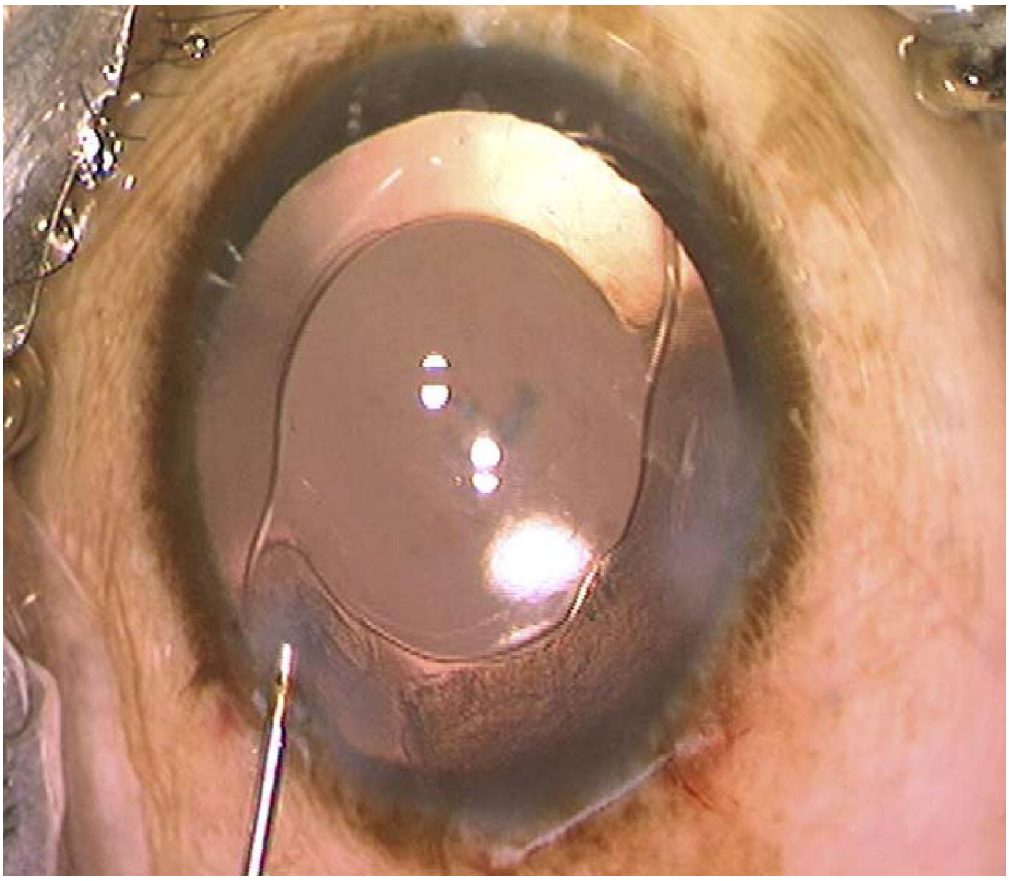


RESIDUAL PLAQUE SEEN OVER THE INTACT

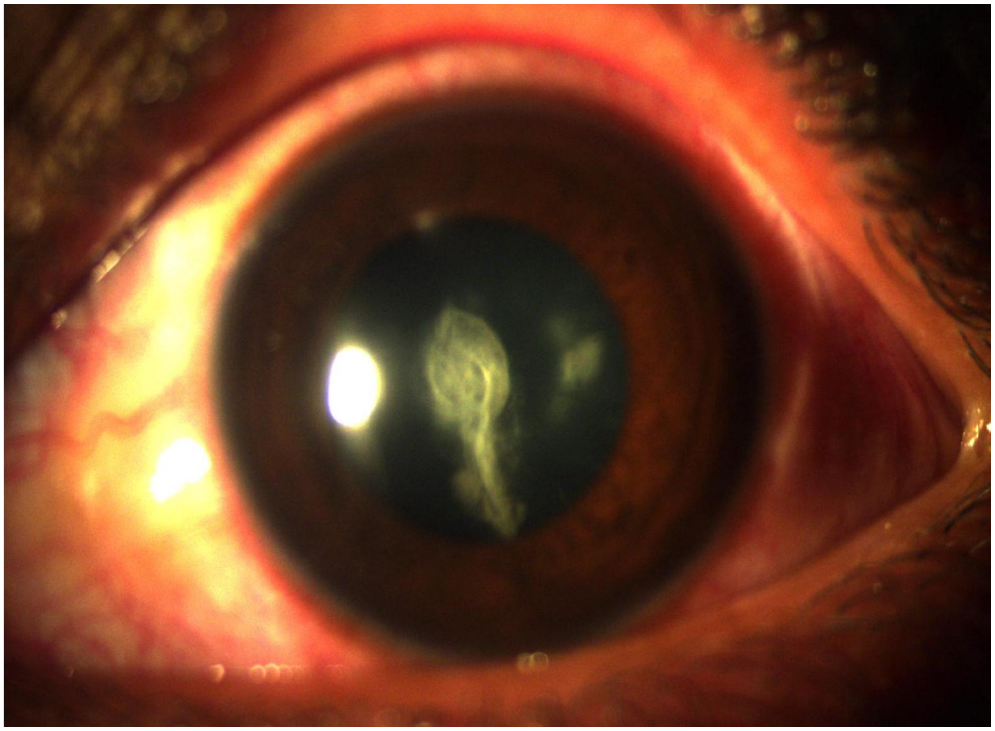
POSTERIOR CAPSULE



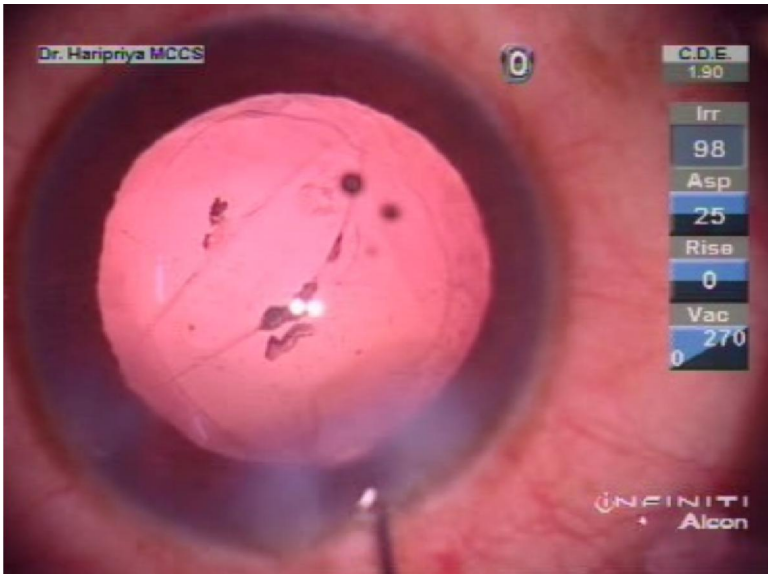
IMPLANTATION OF INTRAOCULAR LENS IN THE CAPSULAR BAG



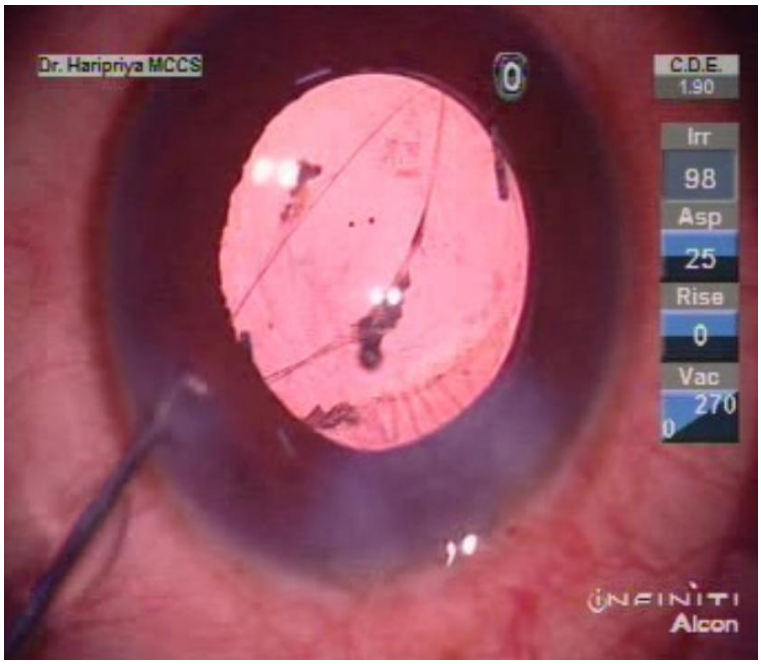
POSTERIOR POLAR CATARACT SHOWING FISH TAIL SIGN



POSTERIOR POLAR CATARACT SHOWING PRE EXISTING CAPSULAR DEHISCENCE



IOL IMPLANTATION IN PPC WITH PRE EXISTING CAPSULAR DEHISCENCE



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PROFORMA

Study no:

Name:

Age:

Sex: (Male:1; Female:2)

Co existing ocular pathology (None-0; Glaucoma-1; Retinal pathology-2; Others-3)

Systemic illness: (None-0; Diabetes-1; Hypertension-2; Others-3)

PRE OPERATIVE EVALUATION

Eye to be operated: (Right-1; Left-2)

Uncorrected visual acuity:

Vision with pinhole:

Anterior segment examination

Pupil (Normal-1; others(specify)-2)

Anterior chamber (Normal-1; Others-2)

Cataract (Associated with pscc-1; Nuclear sclerosis-2; Pre existing posterior capsule dehiscence-3; Others-4)

Fundus: (Normal-1; Others-2)

IOP: mmhg

Axial length:

IOL Power:

INTRAOPERATIVE EVALUATION

Eye to be operated: (RE-1; LE-2)

Type of anaesthesia: (Topical-1; Retrobulbar-2)

Type of surgery:

Duration of surgery:

Section: (Clear corneal-1; Scleral tunnel-2)

Capsulorhexis- any extension (if Yes-1; No-2)

Hydro procedures: Hydrodelineation done for all cases

Intra operative complication:

Posterior capsular rent- (Yes-1; No-2)

Stage at which rent occurred- (Emulsification of the nucleus-1; Epinucleus removal-2; Cortex removal-3)

Nucleus/cortex drop- (Yes-1; No-2)

Anterior vitrectomy done- (Yes-1; No)

Any other complication: (mention)

POST OPERATIVE EVALUATION (DAY 1)

Operated eye- (RE-1; LE-2)

Uncorrected visual acuity:

Vision with pin hole:

Slit Lamp Evaluation

Wound: (Well approximated-1; Gape/leak-2)

Cornea: (Clear-1; Epi.edema-2; DM folds-3; SK-4)

Anterior chamber: (Well formed-1; Shallow-2)

Iritis: (None-1; Mild-2; Moderate-3; Severe-4)

Pupil: (Regular-1; irregular-2)

Cortex/ Epinucleus: (Absent-0; Present-1)

Vitreous: (Absent-0; Present-1)

PCIOL: (In bag-1; In sulcus-2; Decentered-3)

Fundus: (Normal-1; Abnormal-2; Not assessable-3)

POST OPERATIVE EVALUATION (MONTH 1)

Operated eye- (RE-1; LE-2)

Uncorrected visual acuity:

Vision with pin hole:

Refractive error:

Slit Lamp Evaluation

Wound: (Well approximated-1; Gape/leak-2)

Cornea: (Clear-1; Epi.edema-2; DM folds-3; SK-4)

Anterior chamber: (Well formed-1; Shallow-2)

Iritis: (None-1; Mild-2; Moderate-3; Severe-4)

Pupil: (Regular-1; irregular-2)

Cortex/ Epinucleus: (Absent-0; Present-1)

Vitreous: (Absent-0; Present-1)

PCIOL: (In bag-1; In sulcus-2; Decentered-3)

Fundus: (Normal-1; Abnormal-2; Not assessable-3)

Complications: (Absent-0; Present-1)

POST OPERATIVE EVALUATION (MONTH 6)

Operated eye- (RE-1; LE-2)

Uncorrected visual acuity:

Vision with pin hole:

Refractive error:

Slit Lamp Evaluation

Wound: (Well approximated-1; Gape/leak-2)

Cornea: (Clear-1; Epi.edema-2; DM folds-3; SK-4)

Anterior chamber: (Well formed-1; Shallow-2)

Iritis: (None-1; Mild-2; Moderate-3; Severe-4)

Pupil: (Regular-1; irregular-2)

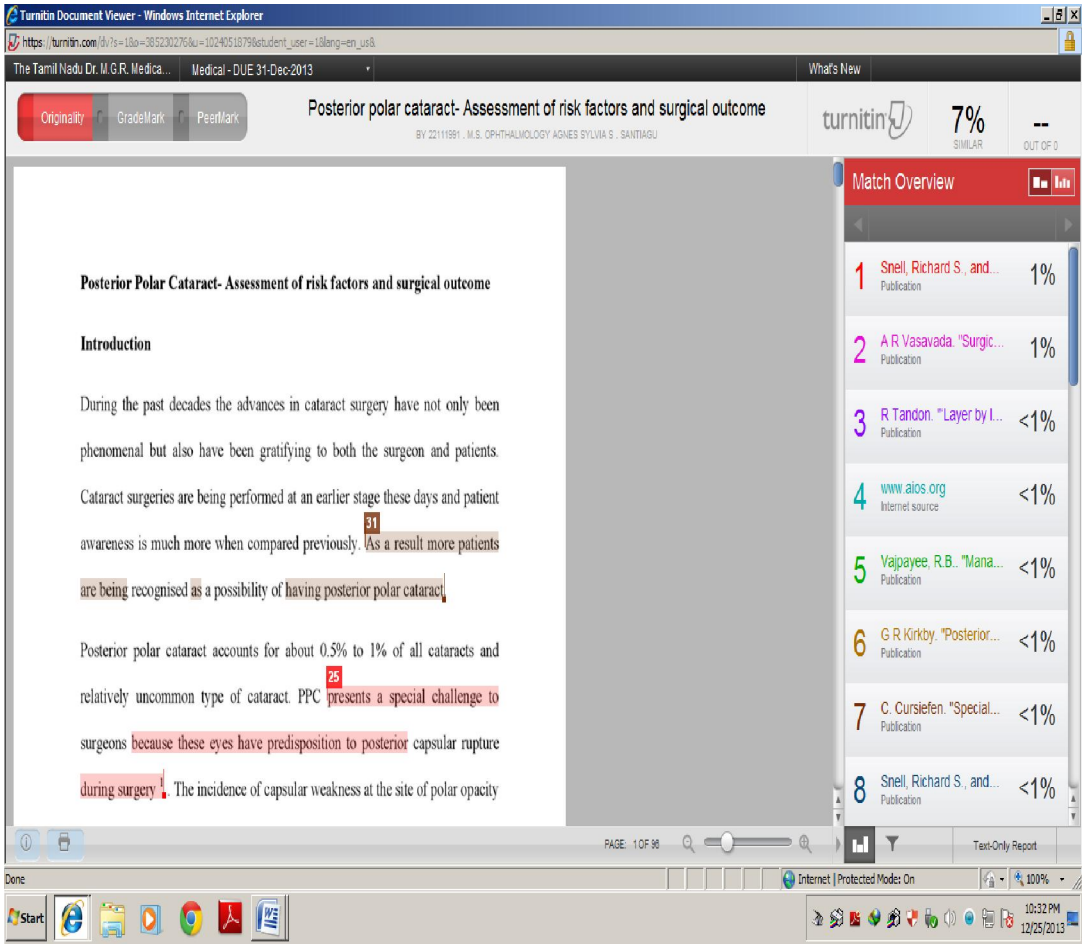
Cortex/ Epinucleus: (Absent-0; Present-1)

Vitreous: (Absent-0; Present-1)

PCIOL: (In bag-1; In sulcus-2; Decentered-3)

Fundus: (Normal-1; Abnormal-2; Not assessable-3)

Complications: (Absent-0; Present-1)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Posterior Polar Cataract- Assessment of risk factors and surgical outcome
Introduction
During the past decades the advances in cataract surgery have not only been phenomenal but also have been gratifying to both the surgeon and patients. Cataract surgeries are being performed at an earlier stage these days and patient awareness is much more when compared previously. As a result more patients are being recognised as a possibility of having posterior polar cataract.
Posterior polar cataract accounts for about 0.5% to 1% of all cataracts and relatively uncommon type of cataract. PPC presents a special challenge to surgeons because these eyes have predisposition to posterior capsular rupture during surgery . The incidence of capsular weakness at the site of polar opacity
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Posterior Polar Cataract- Assessment of risk factors and surgical outcome Introduction During the past decades the advances in cataract surgery have not only been phenomenal but also have been gratifying to both the surgeon and patients. Cataract surgeries are being performed at an earlier stage these days and patient awareness is much more when compared previously. As a result more patients are being recognised as a possibility of having posterior polar cataract. Posterior polar cataract accounts for about 0.5% to 1% of all cataracts and relatively uncommon type of cataract. PPC presents a special challenge to surgeons because these eyes have predisposition to posterior capsular rupture...

Study no.	MR No	Name	Age	Sex	Systemic illness	Study eye	UCVA	Vn with PH	Type of PPC	AXL	IOL power	Anasthesia	Type of surgery	Duration	Section	CCC	Complication	Vitrectomy	POD1-BCVA	1 month	6 months	status
1	2687637	Natesan	48	M	NIL	LE	L_5/60	L 6/24	PSCC with PPC	22.92mm	16.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/9	L 6/6	L 6/6	Improved
2	2736133	Siraj nisha	39	F	NIL	RE	R 6/18	R 6/9	PPC	23.01mm	22	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/6	R 6/6	R 6/6	Improved
3	2612004	Vimal M	21	M	NIL	RE	R 5/60	R 6/36	PPC with PCD	26.14mm	13.5	LA	SICS	20min	S.corneal	Intact	NIL	YES	R 6/36	R 6/36	R 6/36	Same
4	2569339	Purushothaman	52	M	NIL	LE	L 6/12	L 6/9	PPC	23.45mm	21.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/6	L 6/6	L 6/6	Improved
5	2552220	Pushpavalli k	44	F	NIL	RE	R 6/60	R 6/24	NS with PPC	23.94mm	17	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/9	R 6/6	R 6/6	Improved
6	2451596	Puthu muthu	57	M	Diabetic	RE	R 6/60	R 6/18	PSCC with PPC	22.50mm	20.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/9	R 6/6	R 6/6	Improved
7	3296803	Meenakshi k	30	F	NIL	RE	R 6/18	R 6/9p	PSCC with PPC	23.12mm	21	LA	Phacoemulsification	10min	C.corneal	Intact	NIL	NIL	R 6/12	R 6/6	R 6/6	Improved
8	3294971	Kannammal N	36	F	Diabetic	LE	L 6/60	L 6/24	PPC	23.60mm	18.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/12	L 6/12	L 6/12	Improved
9	3293409	Kowsalyadevi S	22	F	NIL	RE	R 4/60	R 6/36	Dense PPC	23.58mm	14.5	LA	Phacoemulsification	15min	C.corneal	Intact	Central fibrous PCO	NIL	R 6/60	R 6/36	R 6/12	Improved
10	3293038	Chinnasami M	68	M	Diabetic	RE	R 6/24	R 6/18	NS with PPC	23.67mm	19.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/12	R 6/6	R 6/6	Improved
11	3299045	Murugesan K	54	M	NIL	RE	R 6/36	R 6/24	PPC	22.37mm	22	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/6	R 6/6	R 6/6	Improved
12	3127256	Vellathai G	70	F	Hypertensive	LE	R 2/60	R 6/60	NS with PPC	22.19mm	22.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/12	R 6/6p	R 6/6p	Improved
13	3122417	Vasanthi K K	53	F	NIL	LE	L 6/36	L 6/9	PPC	22.09mm	23.5	LA	SICS	15min	S.corneal	Intact	NIL	NIL	R 6/9	R 6/6p	R 6/6p	Improved
14	3120796	Tamilmani G	52	M	NIL	LE	L 6/18	L 6/9	PPC	24.52mm	19	LA	SICS	45min	S.corneal	Intact	PCR	YES	L 6/12	L 6/6p	L 6/6p	Improved
15	3115087	Samsath begum J	53	F	NIL	RE	R 6/18	R 6/9	PPC	23.22mm	18.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/9	R 6/6	R 6/6	Improved
16	3103365	Gangi reddy S	56	M	NIL	RE	R 6/18	R 6/9p	PPC with PCD	24.80mm	14	LA	Phacoemulsification	20min	C.corneal	Intact	PC dehiscence	YES	R 6/6p	R 6/6	R 6/6	Improved
17	3075700	Selvaraj P	44	M	NIL	RE	R 6/36	R 6/24	NS with PPC	24.20mm	20	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/12	R 6/6	R 6/6	Improved
18	3136190	Dhanapackiam K	60	F	NIL	LE	L 6/18	L 6/12	PPC	23.56mm	20.5	LA	Phacoemulsification	15min	Scleral	Intact	NIL	NIL	L 6/6p	L 6/6	L 6/6	Improved
19	3140431	Muthaiah S	47	M	Diabetic	RE	R 5/60	R 6/24	PPC	22.40mm	22.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/12	R 6/6	R 6/6	Improved
20	3084435	Martin	62	M	Diabetic,HTN	RE	R 6/24	R 6/9	PPC	23.15mm	18	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/6p	R 6/6	R 6/6	Improved
21	3340624	Venkateshwari S	48	F	NIL	LE	L 4/60	L 6/12	PPC	25.71mm	12	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/6p	L 6/6	L 6/6	Improved
22	3340390	Latha R	37	F	NIL	LE	L 6/12	L 6/9	PPC	22.85mm	21.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/6	L 6/6	L6/6	Improved
23	3339699	Dhamodharan B K	59	M	NIL	RE	R 6/18	R 6/12	PPC	22.52mm	22	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/6p	R 6/6	R 6/6	Improved
24	3339531	Mohan R	60	M	Hypertensive	LE	L 1/60	L 1/60	PPC	24.17mm	19.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/12	L 6/6	L 6/6	Improved
25	3339210	subbulakshmi C	58	F	NIL	LE	L 6/12	L 6/9	PPC	22.21mm	22	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/9	L 6/6	L 6/6p	Improved
26	3338759	Panchavarnam K	55	F	NIL	RE	R 6/18	R 6/18	PPC	24.01mm	20	LA	SICS	10min	Scleral	Intact	NIL	NIL	R 6/12	R 6/6p	R 6/6p	Improved
27	3343465	Ruckmani R	63	F	Diabetic,HTN	RE	R 6/60	R 6/12	PPC	23.38mm	21	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/9	R 6/6	R 6/6	Improved
28	3344620	Manikandan A	20	M	NIL	LE	L 6/18	L6/12	PPC	22.13mm	22.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/9	L 6/6	L6/6	Improved
29	3340987	Sivakami	46	F	NIL	LE	L 6/36	L 6/12	PPC	23.15mm	21.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/9	L 6/6	L 6/6	Improved
30	3345634	Adaikalam	58	M	NIL	RE	R 6/60	R 6/18	PPC	22.11mm	20	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/6p	R 6/6p	R 6/6p	Improved
31	1189029	Adiarasan	40	M	NIL	RE	R 6/18	R 6/12	PPC	23.06mm	20	LA	SICS	15min	Scleral	Intact	NIL	NIL	R 6/6	R 6/6	R 6/6	Improved
32	1192953	Amirtham	45	F	NIL	LE	L 6/18	L 6/12	PPC	22.58mm	22.5	LA	SICS	10min	Scleral	Intact	NIL	NIL	L 6/12	L 6/9	L 6/9	Improved
33	1208867	Kumar M	37	M	NIL	LE	L 6/24p	L 6/24p	PPC	22.10mm	22.5	LA	SICS	15min	Scleral	Intact	NIL	NIL	L 6/9	L 6/9	L 6/9	Improved
34	1190828	Dhinakaran P	35	M	NIL	RE	R 6/12	R 6/12	PPC	24.39mm	19.5	LA	SICS	15min	Scleral	Intact	NIL	NIL	L 6/9	L 6/9	L 6/9	Improved
35	1182382	Devadass	47	M	NIL	LE	L 6/24p	L 6/9	PPC	24.31mm	21.5	LA	SICS	15min	Scleral	Intact	NIL	NIL	L 6/12	L 6/9	L 6/9	Improved
36	1169311	Athiyaman K	50	M	NIL	LE	L 5/60	L 6/12	PPC	23.74mm	21	LA	SICS	20min	Scleral	Intact	NIL	NIL	L 6/12	L 6/9	L 6/9	Improved
37	1174537	Kannan S	29	M	NIL	RE	R 6/18	R 6/18	PPC	26.04mm	14.5	LA	SICS	40min	Scleral	Intact	PC dehiscence	YES	R 6/12	R 6/9	R 6/9	Improved
38	1189993	Ramachandran A	37	M	NIL	RE	R 6/60	R 6/18	PPC	25.41mm	18	LA	SICS	45min	Scleral	Intact	PCR	YES	R 6/18	R 6/9	R 6/9	Improved
39	1213714	Shameem	47	M	NIL	RE	R 6/18	R 6/9	PPC	23.11mm	21	LA	SICS	15min	Scleral	Intact	NIL	NIL	R 6/9	R 6/9	R 6/9	Improved
40	1197976	Sasikaladevi	56	F	Diabetic	LE	L 6/36	L6/12	PPC	22.76mm	19	LA	SICS	15min	Scleral	Intact	NIL	NIL	L 6/12	L 6/9	L 6/9	Improved
41	1168381	Ramanaiah	60	M	NIL	LE	L 6/60	L 6/18	NS with PPC	23.11mm	21	LA	SICS	15min	Scleral	Intact	NIL	NIL	L 6/18	L 6/12	L 6/12	Improved
42	1182826	Rameshwari M	50	F	NIL	LE	L 6/12	L 6/9	PPC	24.08mm	21	LA	SICS	15min	Scleral	Intact	NIL	NIL	L 6/12	L 6/6	L 6/6	Improved
43	1178093	Rathinam S	45	F	NIL	LE	L 6/9	L 6/9	PPC	24.76mm	20.5	LA	SICS	15min	Scleral	Intact	NIL	NIL	L 6/9	L 6/6	L 6/6	Improved
44	1174544	Ravindran	43	M	Hypertensive	RE	R 6/18	R 6/12	PPC	21.45mm	19	LA	SICS	15min	Scleral	Intact	NIL	NIL	R 6/6p	R 6/6	R 6/6	Improved
45	1192328	Sudharsan	42	M	Hypertensive	RE	R 4/60	R 6/36	NS with PPC	23.23mm	21.5	LA	SICS	15min	Scleral	Intact	PCR	YES	R 6/18	R 6/9	R 6/9	Improved
46	1171505	Singathal	61	F	NIL	RE	R 6/60	R 6/36	NS with PPC	21.22mm	19	LA	SICS	15min	Scleral	Intact	NIL	NIL	R 6/12	R 6/6	R 6/6	Improved
47	1149198	Vaitheswaran	33	M	NIL	RE	R 6/18	R 6/12	PPC	25.23mm	16.5	LA	SICS	20min	Scleral	Intact	NIL	NIL	R 6/9	R 6/9	R 6/9	Improved
48	1218433	Muthukakshmi	44	F	NIL	RE	R 6/60	R 6/18	NS with PPC	22.45mm	21	LA	SICS	15min	Scleral	Intact	NIL	NIL	R 6/12	R 6/9	R 6/6p	Improved
49	1167513	Packiam K	62	F	NIL	RE	R 6/60	R 6/18	PPC	23.36mm	20.5	LA	SICS	20min	Scleral	Intact	Residual PCO	NIL	R 6/12	R 6/12	R 6/9	Improved
50	1191715	Pandiammal G	47	F	Diabetic	LE	L 6/18	L 6/12	PPC	22.11mm	20	LA	SICS	15min	Scleral	Intact	NIL	NIL	L 6/12	L 6/9	L 6/9	Improved

51	3355795	Senthil Kumar M	33	M	NIL	LE	L 6/12	L 6/9	PPC	22.68mm	20.5	LA	Phacoemulsification	15min	C.corneal	Intact	Residual PCO	NIL	L 6/12	L 6/12	L 6/9	Improved
52	3355946	Mohamed Ali J	63	M	NIL	RE	R 6/24	R 6/12	PPC	22.75mm	21.5	LA	Phacoemulsification	10min	C.corneal	Intact	NIL	NIL	R 6/6	R 6/6	R 6/6	Improved
53	3359634	VelusamyK	50	M	NIL	RE	R 6/24	R 6/9	PPC	23.63mm	19	LA	SICS	15min	Scleral	Intact	NIL	NIL	R 6/6	R 6/6	R 6/6	Improved
54	3362082	Mohammed Hanifa	65	M	NIL	RE	R 6/24	R 6/12	PPC	24.28mm	18	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/6p	R 6/6	R 6/6	Improved
55	3362875	Mookammal K	46	F	NIL	RE	R 2/60	R 2/60	NS with PPC	22.10mm	22	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/6p	R 6/6p	R 6/6	Improved
56	3363059	Navamani P	56	F	NIL	LE	L 6/36	L 6/24	NS with PPC	23.74mm	17	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/9	L 6/9	L 6/9	Improved
57	3363075	Senthur Pandian K	46	M	NIL	RE	R 6/24	R 6/24	PPC	23.60mm	20	LA	Phacoemulsification	1omin	C.corneal	Intact	NIL	NIL	R 6/6	R 6/6	R 6/6	Improved
58	3363487	Nachimuthu R	42	M	NIL	LE	L 6/18	L 6/9	PPC	23.32mm	20	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/9	L 6/6	L 6/6	Improved
59	3363689	Muthukakshmi A	60	F	NIL	LE	L 1/60	L 1/60	NS with PPC	22.22mm	20.5	LA	SICS	15min	Scleral	Intact	NIL	NIL	L 6/9	L 6/6	L 6/6	Improved
60	3363183	Indira M	51	F	Diabetic	LE	L 6/24p	L 6/12	PPC	23.35mm	20	LA	Phacoemulsification	15min	C.corneal	Intact	PCR	YES	L 6/12	L 6/6	L 6/6	Improved
61	3352134	Selva muneeswaran	41	M	NIL	LE	L 6/6p	L 6/6p	PPC	23.95mm	20.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/6p	L 6/6p	L 6/6p	Improved
62	3354545	Saik rafi ahmed	51	M	Diabetic	RE	R 6/36	R 6/12	PPC	24.44mm	18.5	TA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/9	R 6/9	R 6/9	Improved
63	3366021	Savithramma	60	F	Diabetic	RE	R 6/60	R 6/12	PPC	23.34mm	21	LA	Phacoemulsification	10min	C.corneal	Intact	NIL	NIL	R 6/9	R 6/6p	R 6/6p	Improved
64	3366212	Umayal parvathi	55	F	NIL	RE	R 6/18	R 6/12	PPC	22.66mm	20	LA	Phacoemulsification	10min	C.corneal	Intact	NIL	NIL	R 6/9	R 6/6	R6/6	Improved
65	3366568	Nallaperumal R	64	M	Hypertensive	RE	R 4/60	R 6/36	NS with PPC	23.56mm	19.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/12	R 6/9	R 6/9	Improved
66	3366730	Essakiammal	56	F	NIL	LE	L 6/60	L 6/18	PPC	24.67mm	20.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/9	L 6/9	L 6/9	Improved
67	3368048	Sivakami R	45	F	NIL	LE	L 6/36	L 6/12	PPC	23.12mm	20	LA	Phacoemulsification	15min	C.corneal	Intact	PCR	YES	L 6/12	L 6/9	L 6/9	Improved
68	3368819	Murugeswari	56	F	NIL	LE	L 618	L 6/12	PPC	22.67mm	21	LA	Phacoemulsification	10min	C.corneal	Intact	NIL	NIL	L 6/9	L 6/6	L 6/6	Improved
69	3370968	Marikannu	60	F	NIL	LE	L 6/36	L 6/18	PPC	24.54mm	20	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/12	L 6/9	L 6/9	Improved
70	3373754	Bakiya J	35	F	NIL	LE	L 6/60	L 6/36	Dense PPC	25.34mm	18.5	LA	Phacoemulsification	20min	C.corneal	Intact	Central PCO	NIL	L 6/18	L 6/18	L 6/9	Improved
71	1216923	Vasuki	35	F	NIL	LE	L 6/36	L 6/18	PPC	24.01mm	20	LA	SICS	20min	Scleral	Intact	NIL	NIL	L 6/12	L 6/9	L 6/9	Improved
72	1221844	Vijayalakshmi	35	F	NIL	LE	L 6/18	L 6/18	PPC	23.87mm	21	LA	SICS	20min	Scleral	Intact	NIL	NIL	L 6/12	L 6/6	L 6/6	Improved
73	1054323	Saroja K A	60	F	Hypertensive	LE	L 6/60	L 6/24	NS with PPC	22.78mm	20.5	LA	SICS	15min	Scleral	Intact	NIL	NIL	L 6/9	L 6/9	L 6/9	Improved
74	1217162	Ramalakshumma	47	F	NIL	RE	R 6/36	R 6/12	PPC	21.77mm	19	LA	SICS	60min	Scleral	Intact	PCR	YES	R 6/18	R 6/9	R 6/9	Improved
75	1204890	Ponnuthai	60	F	NIL	RE	R 6/60	R 6/18	NS with PPC	24.56mm	20.5	LA	SICS	15min	Scleral	Intact	NIL	NIL	R 6/12	R 6/9	R 6/9	Improved
76	1207689	Pandiammal A	45	F	NIL	RE	R 6/36	R 6/18	PPC	23.12mm	19.5	LA	SICS	20min	Scleral	Intact	NIL	NIL	R 6/18	R 6/9	R 6/6p	Improved
77	1212365	Perumal	57	M	Diabetic	RE	R 6/24	R 6/24	PPC	24.67mm	21.5	LA	SICS	20min	Scleral	Intact	NIL	NIL	R 6/12	R 6/9	R 6/9	Improved
78	1213421	Seetha	35	F	NIL	LE	L 6/18	L 6/12	PPC	23.78mm	20	LA	SICS	20min	Scleral	Intact	NIL	NIL	L 6/9	L 6/6p	L 6/6p	Improved
79	1202178	Pandi	56	M	NIL	RE	R 6/60	R 6/24	NS with PPC	23.31mm	21.5	LA	SICS	15min	Scleral	Intact	NIL	NIL	R6/12	R 6/9	R 6/9	Improved
80	1215674	Santhammal	57	F	NIL	RE	R 6/36	R 6/18	PPC	22.12mm	20.5	LA	SICS	15min	Scleral	Intact	NIL	NIL	R 6/12	R 6/6p	R 6/6p	Improved
81	1205432	Muthammal	65	F	Diabetic	LE	L 6/60	L 6/36	NS with PPC	24.23mm	21.5	LA	SICS	15min	Scleral	Intact	NIL	NIL	L 6/12	L 6/9	L 6/9	Improved
82	1190987	Selvi	45	F	NIL	LE	L 6/36	L 6/12	PPC	23.65mm	20	LA	SICS	20min	Scleral	Intact	NIL	NIL	L 6/12	L 6/9	L 6/9	Improved
83	1216574	Murugan	60	M	Hypertensive	RE	R 6/60	R 6/24	PPC	24.76mm	18.5	LA	SICS	20min	Scleral	Intact	NIL	NIL	R 6/18	R 6/9	R 6/9	Improved
84	1206540	Vellammal	58	F	NIL	RE	R 6/24	R 6/12	PPC	23.31mm	21	LA	SICS	15min	Scleral	Intact	NIL	NIL	R 6/9	R 6/6	R 6/6	Improved
85	1234532	Valli R	43	F	NIL	LE	L 6/18	L 6/9	PPC	22.45mm	20	LA	SICS	15min	Scleral	Intact	NIL	NIL	L 6/12	L 6/6p	L 6/6p	Improved
86	3378968	Singa reddy	58	M	Hypertensive	RE	R 6/60	R 6/18p	NS with PPC	23.22mm	21	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/12	R 6/9	R 6/9	Improved
87	3378700	Raja N	35	M	NIL	RE	R 6/12	R 6/9	PPC	25.65mm	18	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/9	R 6/6	R 6/6	Improved
88	3377996	Karimulla	60	M	Diabetic	RE	R 6/60	R 6/24	NS with PPC	23.34mm	20.5	LA	Phacoemulsification	20min	C.corneal	Intact	NIL	NIL	R 6/12	R 6/9	R 6/6	Improved
89	3376279	Anburaj N	55	M	NIL	LE	L 4/60	L 6/36	PSCC with PPC	21.17mm	20	LA	Phacoemulsification	10min	C.corneal	Intact	NIL	NIL	L 6/9	L 6/9	L 6/6p	Improved
90	3375103	Roshan Roy	45	M	NIL	LE	L6/24	L6/12	PPC	22.79mm	20.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/6	L 6/6	L 6/6	Improved
91	3375095	Suresh J V	65	M	Diabetic	RE	R6/60	6/36p	NS with PPC	23.78mm	21	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/12	R 6/9	R 6/6	Improved
92	3374770	Lakshmi	60	F	Hypertensive	LE	L 5/60	L 6/36p	PPC	21.20mm	19	LA	Phacoemulsification	20min	C.corneal	Intact	NIL	NIL	L 6/12	L 6/6	L 6/6	Improved
93	3374523	Divya p	56	F	NIL	RE	R 6/36	R 6/18	PPC	23.30mm	20.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/6	R 6/6	R 6/6	Improved
94	3373860	Balasubramanian	58	M	Hypertensive	LE	L 6/36	L6/18	NS with PPC	25.33mm	18.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/9	L 6/9	L 6/6	Improved
95	3373707	Sarmatha begum	40	F	NIL	LE	L 6/18	L 6/12	PPC	23.33mm	21	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/9	L 6/6	L 6/6	Improved
96	3371076	Yasammal	55	F	NIL	RE	R 6/60	R 6/24	PPC	24.23mm	22	LA	Phacoemulsification	20min	C.corneal	Intact	NIL	NIL	R 6/12	R 6/6	R 6/6	Improved
97	3329050	Basheer	58	M	NIL	LE	L6/24	L 6/24	PPC	22.40mm	20	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L6/9	L 6/6	L 6/6	Improved
98	3364042	Prema S	49	F	NIL	LE	L 6/60	L 6/24p	NS with PPC	23.50mm	19	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	L 6/18	L 6/9	L 6/9	Improved
99	3375439	Syed ali	46	M	NIL	RE	R 6/18	R 6/18	NS with PPC	21.50mm	19.5	LA	Phacoemulsification	20min	C.corneal	Intact	NIL	NIL	R 6/9	R 6/6	R 6/6	Improved
100	3374147	Kalavathi	55	F	Hypertensive	RE	R 6/36	R 6/24	NS with PPC	24.44mm	21.5	LA	Phacoemulsification	15min	C.corneal	Intact	NIL	NIL	R 6/12	R 6/6p	R 6/6p	Improved